The Journal

OF THE

AMERICAN DENTAL ASSOCIATION

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MAJOR KENNETH R. COFIELD
Dental Corps, U. S. Army, liaison officer to the American Dental Association

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MANAGEMENT OF PULP EXPOSURE IN THE MIXED DENTITION*

By KENNETH A. EASLICK, A.M., D.D.S., Ann Arbor, Mich.

TWO recent reports indicate that of the spaces created by premature loss of the deciduous molars, from 6[1] to 36[2] per cent of the first deciduous molar spaces and from 40[1] to 62[2] per cent of the second deciduous molar spaces close to such a degree that malocclusion may develop. The frequent sequelae to the early loss of deciduous molars—extrusion of unopposed molars, lingual drifting of incisors, closure of the vertical jaw dimension (Fig. 1), malalinement or impaction of bicuspids and loss of masticatory function—bestir the children's dentist to develop a simple, economical and safe technic for handling exposed vital pulps in the deciduous dentition.

Similarly, a study by Salzmann[3] indicates that a general disturbance of occlusion developed in the young permanent dentition of a group of 500 New York children from 5 to 19 years of age who had lost from one to four permanent molars. Contrary to the conclusion reached by a number of dentists, the second molars of these children did not migrate forward to occupy the spaces that had been made by the extraction of the first molars. Years of clinical observation by children's dentists has taught that, as a rule, immediately upon the removal of a young first permanent molar, the child patient starts on the way toward an early crippled permanent dentition. (Fig. 2.) This observation has led to the development of experimental technics to preserve young teeth even when a cavity reaches the pulp chamber before the roots have completed calcification. (Fig. 3.) Perhaps experimental procedures may be condoned if they preserve young permanent molars and young fractured incisors until root formation progresses to completion.

The object of this paper, at any rate, is to present some of the technics which appear to have a wide application to those teeth of the mixed dentition that had exposed vital pulps.

Read before the Section on Children's Dentistry at the Seventy-Eighth Annual Midwinter Meeting of the Chicago Dental Society, February 24, 1942.

*Associate Professor of operative dentistry, University of Michigan, School of Dentistry.

A DEVITALIZATION-PULPOTOMY TECHNIC FOR DECIDUOUS TEETH

A combined devitalization and pulpotomy technic has been employed since 1930 in the Children's Clinic of the University of Michigan, School of Dentistry, to treat the vital exposed pulps of deciduous teeth. Considerable effort has been devoted to the preparation of a paste that would devitalize promptly with the minimum of pain and danger to parapical tissues. The formula of the paraformaldehyde paste best adapted to this task is as follows:

Paraformaldehyde	1.00
Procaine base	0.30
Vaselin	1.25
Powdered asbestos	0.50
Carmine	0.02

When it is determined that caries has penetrated to the pulp, a sedative, such as oil of cloves or chloretone-eugenol, is applied on cotton for a few moments at the depth of the cavity. The cavity is dried with cotton and an amount of the paste that can be taken on the tip of a plastic instrument is placed over the exposed pulp and is sealed in the cavity without pressure under a thin mix of zinc phosphate cement. The set cement filling is trimmed out of occlusion before the patient is dismissed. Since some patients react unfavorably to the formalin that is slowly liberated from the devitalizing paste, the child patient is supplied with an envelope that contains two doses of acetylsalicylic acid. The envelope is inscribed with directions to take one dose if a toothache ensues and to repeat the dose an hour later if the pain has not ceased. Young's rule is employed to determine dosages for young children.

The child is dismissed for a two-week period to give the slowly acting paraformaldehyde an opportunity to devitalize completely the coronal portion of the pulp. Should the pulp tissue exhibit sensation when tested by an explorer at the second appointment, new paste may be sealed in the cavity for another week.

At the second appointment, the tooth is isolated and sterilized with tincture of mercresin, and sterile instruments are employed to operate on it. If the operator finds it difficult to maintain a dry, uncontaminated field, he may punch one hole in a rubber dam and clamp the tooth to be operated upon. The ivory No. 2A, rubber-dam clamp has been found suitable for the deciduous molars. Usually, dryness has been maintained successfully in the lower teeth, with a milder problem of behavior management, by the use of two No. 3 cotton rolls, one No. 2 cotton roll, an old-style, child's size cotton roll retainer and a saliva ejector that will not irritate the mucous membrane or take much room in a preschool child's mouth. Two cotton rolls, a No. 2 below and a No. 3 above, are placed along the side and beneath the tongue on the side to be treated. Figures 4 and 5 illustrate a suitable equipment and its use.

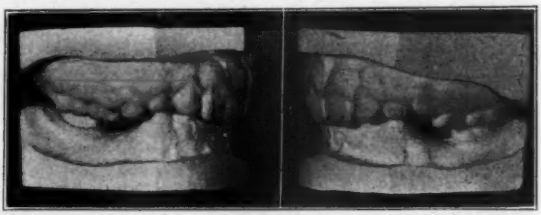

Fig. 1.—Premature loss of mandibular primary molars in boy aged 8. The mandibular permanent incisors were biting against the palatal mucosa.

The pulp chamber is opened wide with a fissure bar, the pulp tissue tested with

an explorer (there should be no sensation or bleeding) and a large round bur revolved about the pulp chamber floor to amputate the desensitized tissue at the level of the openings to the root canals. (Fig. 6.) The pulp chamber is cleaned with sterile cotton pellets and a paste is sealed permanently over the stumps of pulp tissue that remain in the root canals. The formulas for the preparation of the powder and liquid are:

Powder	
Zinc oxide	14.8
Thymol iodide	2.0
White rosin (powdered)	3.0
Paraformaldehyde	0.3

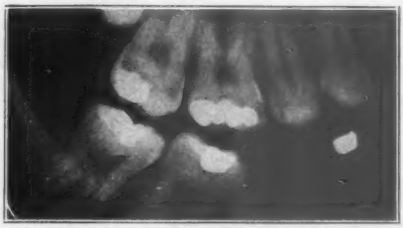

Fig. 2.—An exploratory roentgenogram of 14-year-old boy showing effect on occlusion of early loss of permanent teeth.

Fig. 3.—Root ends of four young permanent teeth; showing effect of early exposure of pulps.

Glycerite of Iodine Liquid	
Iodine (crystals)	0.3
Glycerin	15.0

To prepare, heat ingredients on a hot water bath until solution occurs.

One drop of the liquid is mixed with sufficient powder to secure a paste that has the consistency of whipped cream. Enough of the paste is carried to the pulp chamber to cover the floor. Since the paste is oily and hence difficult to place, a piece of baseplate gutta-percha the size of the pulp chamber may be taken on a smooth hot burnisher and used as a plunger to push the paste to place. The warm burnisher serves to burnish the gutta-percha over the paste. A cement base can be placed at once, a matrix adjusted and a silver amalgam filling inserted immediately.

Some effort has been made to evaluate this pulpotomy technic from the standpoint of safety to health, since its relative ease of performance and the fact that it takes little of the operator's time make it a practical technic in private practice. A large number of treated teeth have been observed for varying periods of time by periodic roentgenographic check-ups. A series of check-up roentgenograms of one treated molar can be studied in Figure 7. The molar shown was

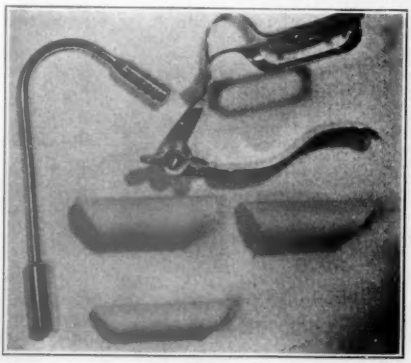

Fig. 4.—Equipment suggested to secure dryness for operations on mandibular primary molars during deciduous or mixed dentition.

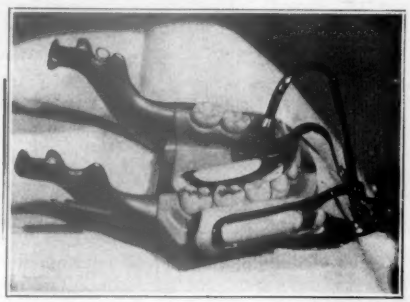

Fig. 5.—Equipment adjusted to isolate deciduous mandibular molars.

maintained for a total period of six years. Its complete root resorption up to the gutta-percha base (right side) will be noted in Figure 8, a photograph taken immediately after exfoliation.

Twenty-four patients with twenty-seven treated teeth have returned to the children's clinic for a check-up during the first semester of the present school year. From the roentgenographic and clinical appearance alone, nineteen of these treated teeth, which have been observed for periods varying from seven months to five years, can be judged as successful—a 70 per cent success for the periods of observation.

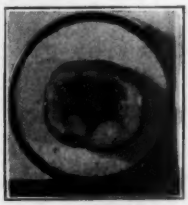

Fig. 6.—Coronal pulp removed by few revolutions of large round bur.

The only true criterion of success in any treated pulp-involved tooth is the absence of harmful bacteria. Such an evaluation is difficult in patients of preschool age or the age of early mixed dentition. Cultures taken with a sterile cotton pellet by wiping out the pulp chamber floor immediately after the pulp amputation have disclosed the presence of bacteria in some teeth and the absence of bacteria in other teeth. Similar findings have been noted in recalled patients when the pulp chambers have been reopened and cultured. Sometimes a positive or a negative culture has been obtained when the initial condition was the reverse bacteriologically. The organisms most frequently recovered were *Streptococcus viridans* and anhemolytic streptococci. The only positive correlation discernible between the presence of bacteria and the clinical appearance in the small group of teeth studied bacteriologically has been positive cultures from the teeth judged to be definite failures clinically.

It may be of interest at this point to note roentgenographic evaluation of the success of the pulpotomy technics employed in the dental clinic of the Eastman Institute of Stockholm.[4] An average of more than three roentgenographic examinations were made of 1,055 pulpotomized deciduous molars in the mouths of 480 children. The treatments were performed by fifty-one different opera-

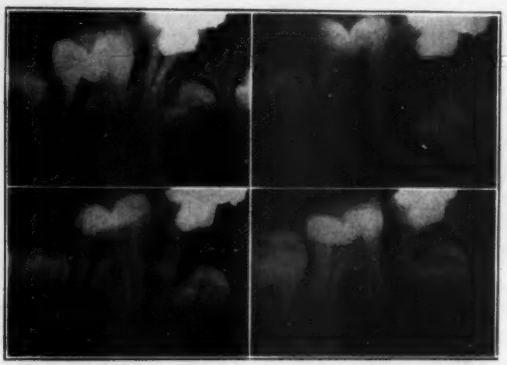

Fig. 7.—Series of check-up roentgenograms of deciduous molar that was retained after treatment by pulpotomy, for six years. The roentgenograms (left to right), above, were taken March 6, 1931; April 2, 1932; below, February 3, 1934, and February 1, 1936.

tors, who used arsenic trioxide in most of the teeth as a devitalizing agent. Satisfactory results were obtained in 57.6 per cent of the teeth studied.

A VITAL PULPOTOMY TECHNIC FOR DECIDUOUS AND YOUNG PERMANENT TEETH

For approximately ten years, experience has been accumulating to show

Fig. 8.—Exfoliated crown from case shown in Figure 7, January 7, 1937. At the right, the pulpal floor of the tooth had resorbed until it exposed the baseplate gutta-percha that was used to push the pulp-chamber paste to place.

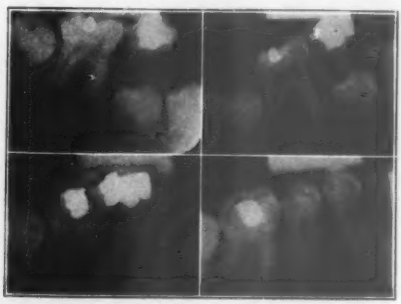

Fig. 9.—Deciduous molar, anesthetized and treated by vital pulpotomy technic. The case was followed roentgenographically for four years. The roentgenograms are arranged chronologically from left to right and upper to lower.

the rationality of the vital pulpotomy technic for young permanent teeth. The choice between the vital pulpotomy technic or the devitalization-pulpotomy technic for primary teeth appears to rest with the operator. By the use of the vital technic, the pulpotomy and entire filling can be completed for a deciduous tooth, frequently in one appointment, if the operator is dexterous in the use of local anesthesia for young patients. Copious hemorrhage into the pulp chamber is one of the complications that sometimes arise with the use of the vital pulpotomy technic. Usually, such hemorrhage can be managed readily by the topical

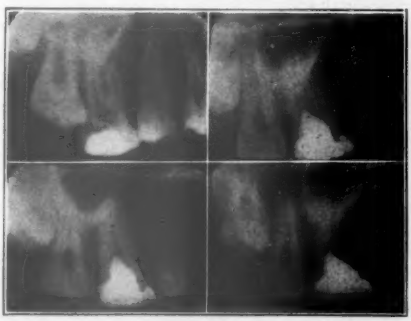

Fig. 10.—Six-year check-up of permanent molar treated by vital pulpotomy technic (roentgenograms taken chronologically from left to right and upper to lower). At two-year intervals, the filling was removed and the vitality of the pulp stumps determined.

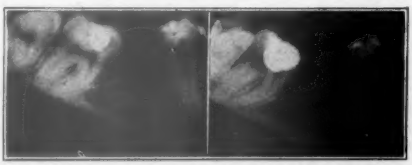

Fig. 11.—Secondary dentin roof deposited over all three root canals in period of ten months, in 21-year-old college student. Left, condition previous to pulpotomy. Right, appearance at ten-month check-up.

application of adrenalin hydrochloride, 1:1000, or neosynephrin hydrochloride, 1 per cent.

Deep anesthesia is imperative if a management problem is to be avoided during a pulpotomy on children's vital teeth, deeper anesthesia, in fact, than is required for the extraction of these teeth.

An inferior dental block anesthesia is used routinely for the lower molars of all children, including the preschool group, the injection being made as nearly as possible at the point where the inferior dental nerve enters its foramen in the mandible. This injection can be reinforced by parodontal infiltration into the socket of each root; and if a rubber dam clamp is to be placed, by a long buccinator nerve block. For the upper teeth, subperiosteal infiltration is used both buccally and lingually. Some slight experience with nasopalatine block anesthesia[5] seems to indicate that it is the anesthesia of choice for the amputation of pulps in the four maxillary incisors. Anesthesia has appeared to be more profound after oil of cloves or choretone-

Fig. 12.—Left lateral incisor in 9-year-old boy which, although knocked loose in accident, regained vitality three weeks later.

eugenol has been sealed in the cavity over the exposed pulp for at least twenty-four hours prior to the pulp amputation.

The amputation of the anesthetized pulp is carried out by the same steps that are taken for the amputation of the devitalized pulp tissue of deciduous teeth. The amputation is made at the level of the pulp chamber floor in molars and at half the length of the available root in anterior teeth. A rubber dam is employed for all permanent molars, exposing only the molar to be treated. Ivory clamps No. 14 and No. 5 have proved successful in the retention of the rubber dam on molars the clinical crowns of which are not entirely erupted.

The pulp chamber is washed with a sterile saline solution and dried with sterile cotton pellets. Previously, the use of the paste already suggested for the devitalization technic in the pulp chamber, followed the vital pulpotomies. A paste of calcium hydroxide and sterile distilled water has been used as the pulp chamber paste, however, ever since the reports published by Teuscher[6] and

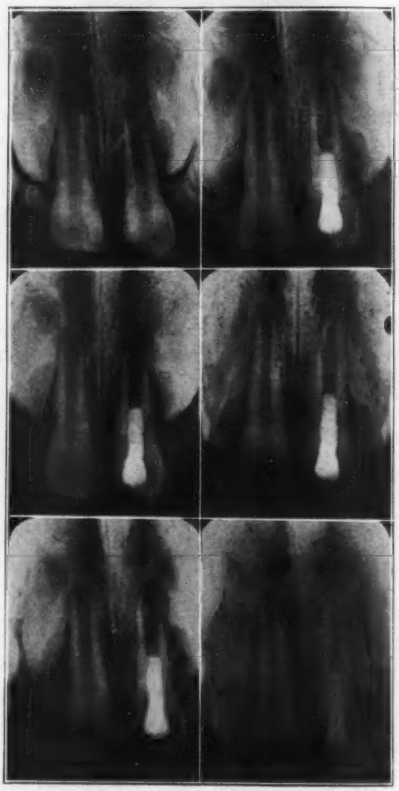

Fig. 13.—Fractured and abscessed central incisor in boy aged 6½. Three bacteriologically negative cultures were obtained, and the root canal was filled to the level of the vital tissue. In a seven-month period, the root-end virtually completed its formation. (Left column downward, condition March 31, April 8, May 13, 1941; right column downward, condition June 16 and October 4, 1941, and January 21, 1942.)

Zander[7] on the rapid calcification of dentin roofs over the vital amputated stumps of root-canal tissue after treatment by a preparation consisting essentially of calcium hydroxide. Figure 9 shows a four-year check-up of a vital pulpotomy performed on a second primary molar in which the previous paste was used. Figure 10 shows a six-year check-up of a maxillary first permanent molar that was amputated at the age of 11 years. Three times during this six-year period, the filling was removed and the vitality of the pulp stumps determined with fine, sharp instruments. Figure 11 shows the roentgenograms of a 21-year-old college student at the time a vital pulpotomy was performed on the second molar and at the recall period ten months later. Calcium hydroxide paste was used in the pulp chamber. At the lateral incisor, which since the accident had consistently given no reaction to vitality tests.

The series of roentgenographic check-ups in Figure 13 tells the story of the treatment of an abscessed fractured incisor in a boy 6½ years of age. The abscess was drained by a labial incision through the periosteum. The following day, the tooth was opened through the lingual surface, flushed out with a syringeful of trichlor, and camphorated paramonochlorphenol was sealed, under zinc phosphate cement. The formula for the preparation of the camphorated paramonochlorphenol follows:

Gum camphor	14
Paramonochlorphenol	6

Mix and permit to liquefy for forty-eight hours.

During an eight-day period, this treatment was repeated daily and cultures were taken. The last three cultures were negative; hence, the root canal was filled with a thick mix of paste as far as the point at which sensation was experienced by the patient. The paste selected consisted of the powder and glycerite of iodin that have been described previously for use in the devitalized deciduous teeth. Successive roentgenograms disclosed the continued calcification of the root end until it was practically complete seven months later.

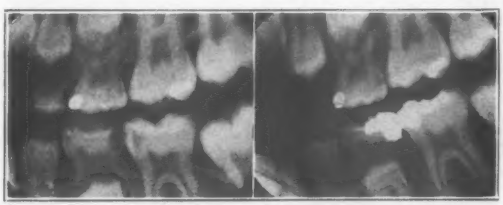

Fig. 14.—Interdental roentgenograms of deciduous molar of girl aged 9½ at time of pulp capping (left) and seven weeks later (right).

time of the second roentgenogram, the filling was removed. A careful exploration with fine, sharp instruments by two operators failed to detect the entrance to any of the three root canals, so completely had they been calcified near the level of the pulp chamber floor.

The pulps of young permanent teeth frequently exhibit remarkable recuperative powers. In a football game, the left deciduous maxillary cuspid of a 9-year-old boy (Fig. 12) was knocked out. The permanent lateral incisor was shifted laterally the distance of its own diameter and the central incisor was forced into linguoversion with its opponent. Three weeks after these teeth were realined and wired to position, vitality returned to the

Some attempt has been made to evaluate bacteriologically the vital pulpotomy technic. Ten patients were recalled during the year 1940 at an averaged elapsed time of one year after

treatment; the fillings and paste were removed, and cultures were taken. Two of the ten teeth gave positive cultures. In both instances, the patients returned because of "soreness" in the treated teeth. (This investigation was made by Henry M. Wilbur, D.D.S., M.S., while a member of the Children's Clinic staff. The bacteriologic examination was made by Mary C. Crowley, M.S.P.H., instructor in dental bacteriology, School of Dentistry, University of Michigan.)

EXPERIENCE WITH A PULP-CAPPING TECHNIC

Because of reports in 1937[8] and later[9] from the Children's Clinic of Columbia University, describing successful pulp-capping technics for deciduous and young permanent teeth, it became evident that further study should be made to reevaluate some previously unsuccessful pulp-capping technics. In 1941, an English report of the successful pulp-capping of vital exposed pulps in rather mature patients was published.[10] Calcium hydroxide solution mixed with certain salts, such as calcium carbonate, calcium phosphate and small amounts of calcium fluoride and magnesium phosphate, was used as the paste for these experiments. In the light of this experience, the staff members of the children's clinic decided to experiment with calcium hydroxide as a pulp-capping agent.

Fig. 15.—Histologic section of treated tooth in Figure 14. (×15.) S. D., band of secondary dentin now covering pulp at point of exposure.

A few deciduous teeth with slight exposure of the pulps were selected in clinic patients during the past year to test the pulp-capping effect of a paste made from a mixture of calcium hydroxide, as the powder, and a suspension of powdered silver nitrate in approximately equal parts of Canada balsam and oil of cloves, as the liquid. After considerable agitation, the liquid suspension was secured according to the following formula:

Canada balsam	7.0
Oil of cloves	7.3
Silver nitrate (powdered)	0.7

The cavities in each instance were sterilized with phenol after the removal of the carious dentin; a small amount of the pulp-capping paste was placed over the exposed pulp, and a temporary filling was inserted.

Figure 14 shows interdental roentgenograms of one of these deciduous teeth, before and after the pulp capping, in a girl 9½ years of age. The tooth was selected for the experiment because it appeared to be rapidly approaching its normal exfoliation period. Seven weeks later, the tooth was extracted and a histologic examination made by D. A. Kerr, A.B., D.D.S., instructor in pathology, Schools of Dentistry and Medicine, University of Michigan. Figure 15 shows a section through the molar at the point of exposure. At this magnification, a band of secondary dentin can be noted covering the point of exposure. This band of secondary dentin is more easily studied in Figure 16. The pulp beneath this band is normal except for some slight irritation immediately beneath the silver-impregnated dentin. Deeper in the pulp

tissue are a few small islets of young bone.

SUMMARY AND CONCLUSIONS

Three technics for the management of exposed pulps in deciduous and young permanent teeth have been reviewed. Certain conclusions can be drawn:

1. Roentgenographically, the results of paraformaldehyde devitalization of exposed vital pulps in deciduous teeth and the subsequent treatment by a pulpotomy technic indicate a relatively high degree of success, although some refinements of diagnosis and treatment are indicated to eliminate the failures.

2. Amputation of the anesthetized vital exposed pulps in deciduous and young permanent teeth has been accomplished with considerable success. Rapid calcification has followed the use of calcium hydroxide as a pulp chamber paste, and completion of uncalcified root ends has followed the employment of the vital pulpotomy technic.

3. Recent evidence of promotion of secondary dentin formation by a pulp-capping technic in the few instances in which this technic has been utilized in deciduous teeth warrants further experimental work, including histologic study, of teeth that have been treated by pulp-capping.

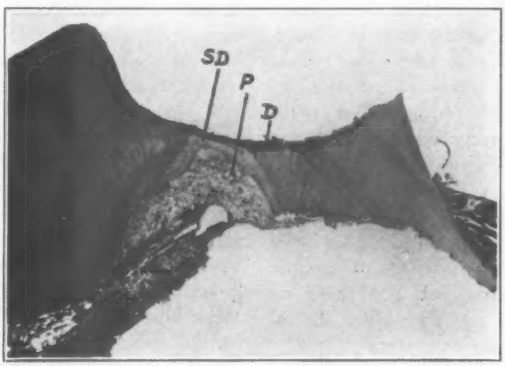

Fig. 16.—Further enlargement (×100) of repaired area indicated in Figure 15. S. D., repair band of secondary dentin. Normal pulp tissue is indicated at P; while at D, silver impregnated dentin can be noted.

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HISTOLOGIC STUDIES ON THE REACTION OF ALVEOLAR BONE TO VITALLIUM IMPLANTS

(A PRELIMINARY REPORT)*

By Joseph L. Bernier,* D.D.S., M.S., and Clarence P. Canby,† D.D.S.,
Washington, D. C.

NUMEROUS investigations have been conducted to determine the efficacy of internal fixation of fractures by the use of various metals. For many years, no satisfactory results were forthcoming. As early as 1894, Doisy,[1] using aluminum, found that considerable local irritation resulted, but erroneously concluded that because of the slight toxicity of the salts produced, this metal was safe to use. The generally unsatisfactory results of use of silver wire were shown by Algrave,[2] in 1911. Rugh,[3] experimenting with several different metals, each of which had been placed in cultures of *Staphylococcus aureus* and *B. pyocyaneus,* found that iron, steel, copper, zinc and nickel were frequently associated with an aseptic suppuration, while silver, gold and tin were unaffected by the body fluids. Numerous other investigators[4, 5, 6, 7, 8, 9] not only have duplicated many of these experiments, but also have approached the problem from other aspects. None of these experiments, however, were checked by histologic examination of the tissue. Thus, some of the general statements as to the destruction and delayed repair of bone must be discounted when attributed to the action of any particular metal.

Very few of these observers placed much stress on the possibility of electrolysis following the use of metals of different potential. Some early references are noted, but these are not substantiated by any accurate chemical studies. Rolland[10] and Galfre[11] made direct references to electrolytic action, but drew doubtful conclusions as to the true nature of the process. Crétin and Bouyanne[12] investigated the variable reaction of certain metals from a histologic standpoint. They attempted to find some rational background for the behavior of metals when implanted in certain tissues, concluding that any metal would cause some destruction and, in general, would retard the repair of bone. With the exception of the latter work, virtually all of the experiments were based on macroscopic and roentgenographic findings alone.

It remained for Venable, Stuck and Beach[13] to analyze the findings of these previous investigators and to approach the subject in a truly analytic fashion. Observing both human and animal experimentation, they were able to show that an electrolytic force is produced when metals of a different potential are inserted in tissues and that this action results in the production of metallic salts in the local tissue fluid. This causes an excessive cellular proliferation and in general inhibits the growth of new bone. These investigations led to their sugges-

From the Army Medical Museum and the Department of Preventive Medicine and Clinical Pathology, Army Dental School, Army Medical Center.

*Major, Dental Corps; secretary and pathologist to the Registry of Dental and Oral Pathology of the American Dental Association.

†Lieutenant Colonel, Dental Corps.

tion that an alloy similar to vitallium, which consists of approximately 65 per cent cobalt, 30 per cent chromium and 5 per cent molybdenum, and in which vanadium had been substituted for the chromium, would be acceptable for fixation of fractures. They state, however, that their experiments with vitallium did not reveal any liberation of chromium and that the metal was in general satisfactory. The following year, these authors[14, 15] introduced additional evidence to substantiate these claims, re-

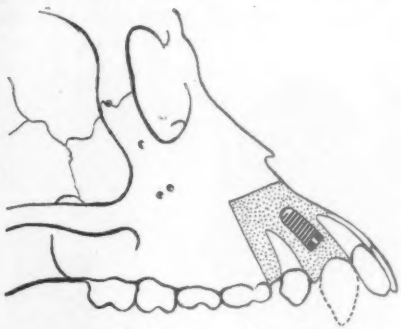

Fig. 1.—Position of maxillary implant in alveolus of cuspid tooth.

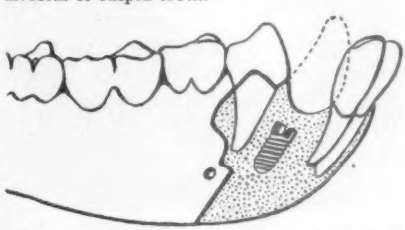

Fig. 2.—Position of mandibular implant in alveolus of cuspid tooth.

porting forty-six clinical cases in which vitallium appliances had been used with no apparent tissue reaction. They further stated that after the use of vitallium plates, screws or nails, perfect fixation was attained with no bone necrosis and a normal process of repair. This metal, they believe, is essentially non-electrolytic and can be satisfactorily used in the field of traumatic bone surgery. Certain of their experiments were substantiated by careful histologic examination of the tissue concerned.

These investigations have led to a fairly widespread use of this metal in

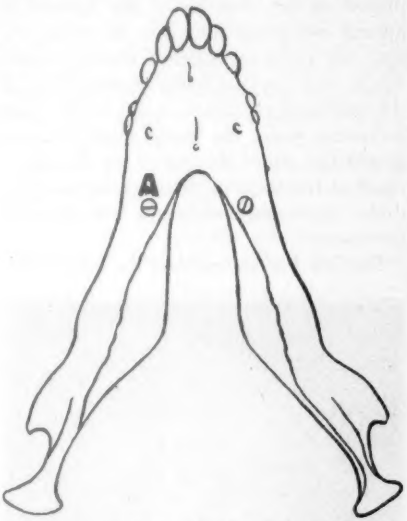

Fig. 3.—Position of extra-oral implant in lower border of mandible. The head of the screw is shown at A.

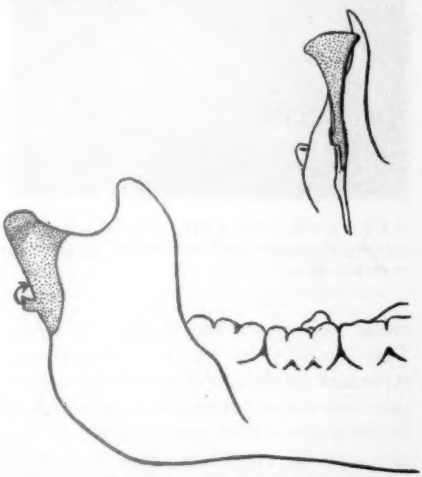

Fig. 4.—Replacement of condyle of mandible with vitallium cap.

operative procedures,[16, 17, 18, 19, 20] most of which further emphasized its value in

traumatic surgery. Strock,[21] in 1939, on the basis of both human and animal experimentation, suggested that metallic implants made of vitallium could be placed in the alveolus of the tooth following extraction and thus be used as a base for replacing certain missing teeth. There was no histologic examination of the tissues to substantiate this claim. The following year, the same author[22] suggested the use of this metal for the treatment of fractures of the edentulous mandible, again emphasizing its toleration by the tissues.

Bigelow has stated that the use of this metal may lessen the danger of sepsis. This appears to be an unwarranted statement in view of the available literature and the experiments to be reported in this paper, which seem to indicate that although the vitallium is non-electrolytic when inserted in the tissue, it does not necessarily exert any inhibitory action on the growth of organisms. It appears that careful, aseptic surgical procedures are essential for the excellent results reported with the use of this metal. In view of the absence of detailed histologic support of many of these findings, it was decided that animal experimentation would be conducted in an effort to determine the reaction of the supporting dental tissues to vitallium inserts, this information to be obtained by careful histologic analysis.

Fig. 5.—Lateral x-ray film of head of monkey showing vitallium implant in position in mandible.

Fig. 6.—Mesiodistal section through block which contained maxillary implant. The space occupied by the implant is indicated at A. There is normal attachment of the adjoining tooth (B) and the septae of bone (D) at the base of the implant.

ANIMAL EXPERIMENTATION

Monkeys of suitable size were selected for this experiment. The implants were flat-headed pointed screws of varying sizes, as shown in Figures 1 and 2. It was necessary to select animals the jaws of which were of sufficient size to permit easy insertion of the implant so that it would fit snugly and yet not fracture the buccal or lingual plates while being inserted. The implants were placed sufficiently deep to prevent forcible removal by the animal. Both the mandib-

ular and the maxillary implants were placed in the alveolus of the cuspid teeth after extraction, as shown in Figures 1 and 2. The extra-oral implants were somewhat smaller and sharply pointed inasmuch as they were inserted in the lower border of the mandible directly through the cortical plate, as seen in Figure 3. Points of reception in the cortical bone were prepared for these implants with a 557 cross-cut fissure bur after incision. Intravenous pentobarbital sodium anesthesia was used in all instances. Strict surgical asepsis was maintained throughout all of the operations, particular care being exercised during the insertion of the extra-oral implants, which were left protruding slightly above the skin surface in an attempt to determine the feasibility of using such screws as anchorage in the external fixation of fractures. All histologic studies were made by the Registry of Dental and Oral Pathology of the American Dental Association (J.L.B.).

Fig. 7.—Higher power photomicrograph of blocked area in Figure 6, showing fibrous character of marrow tissue.

Monkey No. 1: Two implants were inserted in the jaws of this animal. Both were placed in the alveoli of the cuspid teeth, after extraction, one in the maxilla, the other in the mandible. Figures 1, 2 and 5 show these in place. They were inserted in September 1939 and allowed to remain until July 1940, a period of ten months, after which the animal was killed and blocks containing the metal implants removed from both the mandible and the maxilla.

Monkey No. 2: In this animal, both intra-oral and extra-oral implants were inserted. The intra-oral implants were placed essentially the same as in the case of monkey No. 1. The extra-oral implants were inserted in the lower border of the mandible in the bicuspid region, as shown in Figure 3. The heads of the screws were allowed to project slightly above the surface. The four implants were placed in position in May 1941 and were removed after the animal was killed, in September 1941; that is, after a period of approximately six months. Blocks were again removed as described above.

Fig. 8.—Higher power photomicrograph of single bone projection. The fibrous tissue pad (C) suggests a partially abortive attempt to produce a periodontal membrane. Osteoblastic activity is seen at B.

Monkey No. 3: In the third animal, two intra-oral implants were placed in the maxillary and mandibular cuspid areas as previously described. These were inserted in May 1941 and the animal was killed in January 1942; that is, after a period of approximately nine months. However, the implants were in position for only three months of this time, as they were forcibly removed by the animal in March 1942. It was decided to allow the monkey to live this additional period to determine the degree and character of repair that might be expected after such a period of implantation.

Technic: In each instance, the entire head was removed and fixed in 10 per cent formalin. Approximately six times the volume of the specimen was used. After a period of approximately one week, during which the specimen in the fixative was kept in the icebox at 36° F. to insure more accurate fixation, blocks were removed from the areas containing the implants. The implants were carefully removed with a jeweler's screwdriver and the blocks decalcified, dehydrated and embedded in paraffin according to the usual technic.

Fig. 9.—Section from block containing mandibular implant. The vascularity of the marrow and the mosaic pattern of the bone (A) are to be noted.

Fig. 10.—Lower power photomicrograph showing position of right extra-oral mandibular implant. There is an intense osteomyelitic reaction at A.

FINDINGS

Monkey No. 1: Figure 6 shows a mesiodistal section through the block which contained the maxillary implant. The space which it occupied is indicated at A. The formation of new bone projections in the serrations of the implant can be clearly seen. There is no evidence of an inflammatory exudate and the attachment of the adjoining tooth (B) is essentially normal. There is some fibrous replacement of the marrow substance (C) incident to the formation of the new bone. The layer of bone (D) across the bottom of the implant indicates its relative stability within the maxilla. Figure 7 is a higher power photomicrograph of the blocked area in Figure 6. The new bone that has formed in the serrations of the implant is essentially normal. Osteogenesis is still an active process, as evidenced by the fibrous character of the marrow tissue (A), its prominent vascular feature, and the osteo-

Fig. 11.—Position of left extra-oral implant. The osteomyelitic reaction (B) is similar to that seen on the right side. Focal abscesses are indicated at A.

Fig. 12.—Higher power photomicrograph of blocked area in Figure 10; showing scattered inflammatory cells.

Fig. 13.—Higher power photomicrograph of tip of implant shown in Figure 11. The mandibular nerve can be seen.

Fig. 14.—Character of exudate in region surrounding both extra-oral implants. It is essentially chronic, consisting of lymphocytes, macrophages and plasma cells.

blastic activity, which is more clearly seen in the higher power picture (Fig. 8, b). The fibrous membrane (C) surrounds the projection into the serration.

This is an osteogenic tissue not unlike the periodontal membrane and its formation is interpreted as an abortive attempt of this tissue to assume its normal function, that of cushioning the tooth. It is an actively proliferating tissue, as evidenced by the fulness of the cell nuclei. There is a total absence of any inflammatory exudate.

Figure 9 is taken from the block that contained the mandibular implant. The findings are essentially the same as those noted in the maxillary block. Active osteogenesis and increased vascularity of the marrow are again prominent findings. As in the case of the maxillary implant, there seems to be no indication of irritation incident to the use of the vitallium alloy. The irregular lamination of the bone (A) indicates active osteogenesis.

Monkey No. 2: Both intra-oral and extra oral implants were inserted in this animal. Figure 10, a low-power photomicrograph, shows the relative position of the extra-oral implant on the right side, and Figure 11 shows that on the left side. In both instances, there has been an active rebuilding of bone into the serrations of the screw. However, one can readily see the massive inflammatory process (A, B) spread diffusely throughout the marrow cavity on each side. This is essentially a chronic reaction although there are areas of focal abscesses. (Fig. 11, a.) In both instances, the implant appears to have impinged on the mandibular nerve although there has been no serious injury to that tissue. Figure 12, which is a higher power photomicrograph of the blocked area in Figure 10, shows the character of the

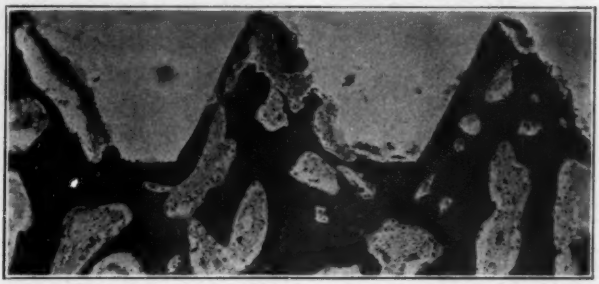

Fig. 15.—Photomicrograph of tissue immediately adjacent to intra-oral mandibular implant in monkey No. 2. The reparative process is active and essentially normal. There are scattered inflammatory elements.

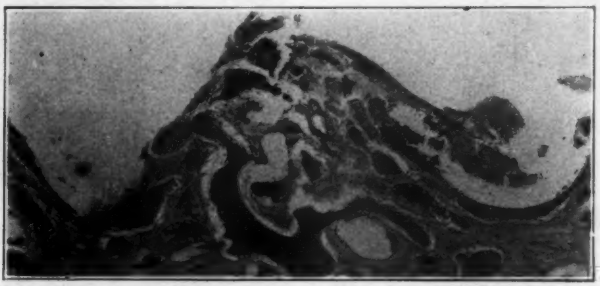

Fig. 16.—Higher power photomicrograph of one projection. The marrow is fibrous and quite vascular. Osteogenesis is active.

reparative process. The proximity of the inflammatory exudate has interfered only slightly with the formation of new bone, there being much evidence to suggest an early reparative process. The fibrous tissue is composed of young, spindly active cells. Figure 13 is a higher power photomicrograph of the extra-oral implant from the left side. The mandibular nerve is shown in some detail. The collections in chronic inflammatory exudate in the marrow tissue can be seen. Figure 14 shows the character of this exudate. Numerous lymphocytes and plasma cells, together with a sprinkling of granular leukocytes, are evident.

Fig. 17.—Section from block that contained mandibular implant from monkey No. 3. There has been some replacement of bone in the space occupied by the implant.

The intra-oral implants show essentially the same findings as were reported in the first animal. Figure 15 shows the reaction of the bone and soft tissue immediately adjacent to the mandibular implant. Some inflammatory exudate is noted in the fibrous marrow tissue. However, this is not a great amount and is probably an extension of the exudate shown in Figure 10. There has been

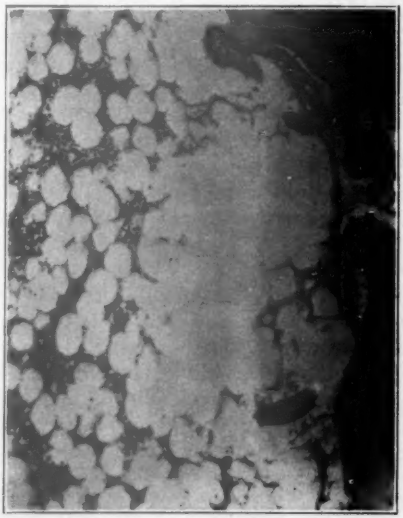

Fig. 18.—Chronic inflammatory exudate noted in region adjacent to implant described in Figure 17.

Fig. 19.—Area occupied by maxillary implant; showing focus of chronic inflammatory exudate.

active normal osteogenesis along the edge of the implant. Figure 16 is a higher power photomicrograph of one of the projections. The fibrous character of the marrow tissue and its vascularity are again evident. Bone formation has not progressed so far in this particular area. Again, one is impressed with the tolerance of the tissue to this material and the relative absence of inflammatory exudate.

Monkey No. 3: In this animal, the implants were entirely intra-oral and were removed three months after insertion. The animal was allowed to live an additional seven months. Figure 17 shows the area formerly occupied by the mandibular implant. Its outline is still discernible. There has been some bone regeneration and the central cavity contains considerable normal marrow tissue. There is some inflammatory exudate in this marrow tissue. (Fig. 18.)

Figure 19 shows the area occupied by the maxillary implant. The outline of the screw is not so readily seen in this picture. The outstanding feature is the focus of inflammatory exudate localized in this area. Most of these cells are small lymphocytes and plasma cells, as shown in Figure 20. There is considerable fibroblastic activity along the edge of this inflammatory focus.

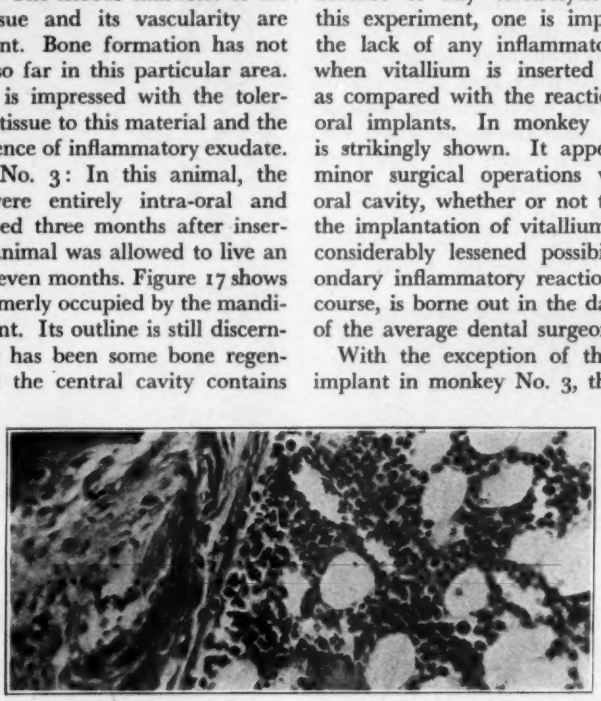

Fig. 20.—Higher power photomicrograph; showing chronic character of exudate. Remaining collagenous fibers can be seen at lower right hand corner.

DISCUSSION

It appears that vitallium alloy remains essentially inert when in contact with the body tissue. This has been adequately explained on the basis of the total absence of any electrolytic force. In this experiment, one is impressed with the lack of any inflammatory reaction when vitallium is inserted intra-orally as compared with the reaction to extra-oral implants. In monkey No. 2, this is strikingly shown. It appears that in minor surgical operations within the oral cavity, whether or not they involve the implantation of vitallium, there is a considerably lessened possibility of secondary inflammatory reaction. This, of course, is borne out in the daily practice of the average dental surgeon.

With the exception of the maxillary implant in monkey No. 3, they all were soon covered by a normal mucous membrane. In the former case, the difficulty of a firm fixation undoubtedly accounts for the secondary inflammatory process. This we do not feel is influenced either way by the presence of the vitallium metal.

CONCLUSIONS

It is not possible to draw conclusions from this experiment. It seems, however, that although vitallium alloy is extremely well tolerated by the tissues, the incidence of secondary infection cannot be discounted. When it is inserted intra-orally, this possibility is considerably less-

ened. This experiment is being conducted along more extensive lines to determine the feasibility of replacement of the mandibular condyle, as shown in Figure 4. The implants are at present in place in experimental animals, and the result of this experiment will be reported at a later date. In addition to this, it is planned to insert additional implants, using sulfonamide drugs at the time of application to determine the efficacy of this form of chemotherapy. These findings will also be included in a later report. It is obvious from previous reports and these limited experiments that vitallium alloy has a definite place in the external fixation of fractures provided one does not exclude the possibility of secondary infection.

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GINGIVECTOMY BY CHEMOSURGERY

By Balint Orban, M.D., D.D.S., Chicago, Ill.

EXPERIENCE gathered over a period of many years from studies on the dental pulp and gingivae has shown that the use of paraformaldehyde will cause tissue coagulation, to a desired extent, in the elimination of gingival pockets.

The value of formaldehyde in gingival treatment was recognized by Schwarz[1] in 1917. He recommended packing the gingival pocket with cotton saturated in formaldehyde to reduce the depth of the pocket. He also advocated the use of a mouthwash containing formaldehyde. Several years later,[2] he investigated the action of a pulp-capping cement that presumably contained paraformaldehyde and found it valuable in eliminating gingival pockets. Since then, no investigations or reports can be traced in the literature. Buckley[3] advocated the use of formaldehyde as a dentin-desensitizing agent. However, Buckley's desensitizing paste contained paraformaldehyde in a very high concentration (20 per cent) and its use frequently caused devitalization.

In investigating the action of paraformaldehyde on the dental pulp, I have frequently observed coagulation of the gingivae. However, systematic experimental investigation of this action was not undertaken at the time.[4]

Paraformaldehyde is used in general medicine as an intestinal disinfectant in children, and as a general antiseptic, disinfectant and deodorant. Other chemicals are used in general surgery for the removal of affected tissues, such as salicylic acid for the removal of warts and corns. More recently, the use of zinc chloride has been advocated for the removal of gangrenous tissues in diabetes.[5] Phenol, zinc chloride, trichloro-acetic acid and silver nitrate are also frequently used for elimination of excess tissue.

Paraformaldehyde is the polymeric form of formaldehyde $(CH_2O)_nH_2O$. It is a white powder, not easily soluble, liberating formaldehyde when it goes into solution. For the purpose of eliminating the gingival pocket, it was incorporated in a zinc oxide powder, in a concentration of 5 per cent by weight. The formula of the zinc oxide pack is identical with that advocated by Wallace and Hansen, representing the Council on Dental Therapeutics of the American Dental Association.[6] The formula of the powder is: zinc oxide, 70 parts; zinc acetate, 1 part; zinc stearate, 1 part, and rosin, 28 parts, with 5 parts of paraformaldehyde added as the active agent. The liquid consists of eugenol (85 parts) and cottonseed oil (15 parts). Zinc acetate regulates the setting time and its percentage must be changed if the brand of zinc oxide and of rosin are changed. Each new mixture must be tested as to setting qualities.

The zinc oxide-paraformaldehyde pack, called "medicated cement pack," is mixed with the liquid to the consistency of cement used for setting an inlay. By means of a spatula, a few cotton fibers are incorporated in the mixture before it is applied to the gingival pocket. Small batches of the medicated

From the Foundation for Dental Research of the Chicago College of Dental Surgery, Loyola University.

Fig. 1.—Six biopsy specimens from patient treated with medicated cement pack. A, before treatment: a, epithelium; b, chronic inflammatory infiltration. B, two days after application of pack: a, normal epithelium; b, necrotic epithelium; c, necrotic connective tissue; d, demarcating leukocytic infiltration. C, four days after application of pack: a, necrotic tissue, which becomes separated from underlying tissue (b). D, eight days after application of pack. In a, the wound surface is clean and free of necrotic tissue. E, ten days after application of pack: a, epithelium starting to migrate over wound surface. F, fourteen days after application of pack: a, epithelium covering entire wound surface; healing complete.

cement pack and cotton are packed to the bottom of the gingival pocket, filling the entire space. When the pack has hardened, its surface should be painted with cavity varnish to prevent escape of the formaldehyde into the saliva, reducing the action of the pack and, possibly, irritating the cheeks or lips.

The clinical result of the action of this medicated cement pack is a coagulation of the free margin of the gingivae, due to necrosis of the tissues. When the pack is removed, two days after application, the margin of the gingiva is leathery and whitish gray. The necrotic tissue drops off within from four to eight days, without causing any pain or bleeding, and thus the gingival pocket is eliminated.

tomy and histologic examination of the excised tissues.

Figure 1, A shows an extremely inflamed gingiva. The infiltration is made up almost entirely of plasma cells, with only a few leukocytes near the surface. The epithelium is very irregular and shows a typical acanthosis. The connective tissue is almost exposed in some places. Clinically, the gingiva was swollen and bluish red. The pockets were from 4 to 6 mm. deep and showed suppuration on pressure. A large amount of calculus was present on the root surfaces. (Fig. 2, A.)

The effect of application of the medicated cement pack, after two days, is illustrated in Figure 1, B. The normal

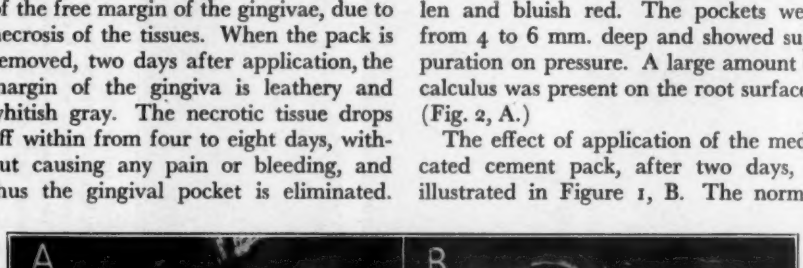

Fig. 2.—A, inflamed gingiva, with deep pockets. B, excess gingival tissue removed by action of medicated cement pack.

The dentin-desensitizing action of paraformaldehyde is very effective in eliminating gingival pockets. After surgical removal of gingival tissues, and sudden exposure of root surfaces, the sensitiveness of the roots is very annoying. In most cases, this is counteracted by the desensitizing effect of the paraformaldehyde. In a 5 per cent concentration of paraformaldehyde in zinc oxide, no risk of pulp injury is involved.

The action of the medicated cement pack and the healing of the gingival wounds caused by its action were studied by means of surgical gingivec-

epithelial surface can be observed on the left side of the picture (a). There is a sharp distinction between the affected and the normal surfaces: on the affected surface, the epithelium is thin and some of the superficial layers are missing (b). The underlying tissue is, in parts, necrotic and has lost its staining ability (c). This necrotic tissue is separated from the other connective tissue by a barrier of cells consisting of leukocytes (d). The demarcated, necrotic tissue was cast off from the underlying normal tissue four days after treatment, as illustrated in Figure 1, C. The necrotic surface (a) can be observed,

partly in contact with and partly separated from the rest of the tissue (b). After four days more (Fig. 1, D), all the necrotic tissue had been cast off and a clean wound surface was exposed (a). Clinical experience has shown that the necrotic surface is cast off from six to eight days after application of the medicated cement pack. The separation of the necrotic tissue is accomplished by the demarcating action of leukocytes.

After the necrotic tissue has been cast off, the epithelium begins to push itself over the surface of the connective tissue (a), as shown in Figure 1, E, ten days after application of the medicated cement pack. Within four days more, the entire surface is covered with epithelium, as shown in Figure 1, F. Figure 2, B, illustrates the case after gingival treatment has been completed. The pockets have been eliminated and the gingival margin corresponds to the attachment of the gingiva to the teeth.

For the first ten days of treatment, the dominating inflammatory cells are leukocytes, but later, as in cases treated with other methods, the number of leukocytes is diminished and the development of fibrous connective tissue sets in, with cells characteristic of chronic inflammation. The presence of chronic inflammatory elements in the gingivae is due to continuous irritation of the gingival tissues in which the circulation is deficient and the cellular metabolism faulty. Proper "home care," with massage of the gingivae, will be of great aid in combating this condition. Experiments concerning the action of different drugs on chronically inflamed gingival tissue have shown that oxygen is a very potent therapeutic agent in combating chronic inflammation and also in stimulating tissue to regenerate.[7] It can be applied in the concentrated form of superoxol. The acidity of superoxol has to be neutralized by the addition of one drop of 5 per cent sodium bicarbonate to 10 or less drops of superoxol before use.

By the action of the medicated cement pack, gingival pockets can be eliminated without anesthesia, and without pain or bleeding. Paraformaldehyde is limited in action and will not penetrate the tissues deeper than about 1 mm. For the desired result, it may be necessary to repeat the packing, especially if the gingiva is hypertrophic. The pack should be applied for not longer than two days, since the action of the paraformaldehyde is exhausted after that time and will not continue though the pack is left in place longer. On the other hand, leaving the pack in will delay the progress of healing and is therefore undesirable. The pack should be removed after two days and be replaced by some neutral wound dressing, which should be changed frequently.

Special care should be taken in the application of this new material because, if it is not properly used, the results may be undesirable. Such unfavorable action was observed when the pack was applied in deep pockets extending below the bone margin: necrosis of the bone developed and eight to ten days was required for the necrotic bone to sequestrate and be cast off. Thereafter, the gingiva healed without delay. One of such cases observed was that of a lower cuspid tooth in which the pocket reached deeply between the cuspid and the lateral incisor, but the pocket was localized to the cuspid. Another case involved the bifurcation of an upper first molar, the pocket extending from the distal side to between the roots. However, in neither case was the damage serious and the tissues regenerated in a short time. In a case in which the medicated cement pack and cotton had been packed too tightly, all around several front teeth, the formation of an acute lateral abscess was observed. The pack was removed and the abscess lanced, with recovery within a few days without any permanent damage.

If patients are allergic to formaldehyde, the pack has to be removed at once and the tissues must be thoroughly

washed if any undesirable effect is observed and if suspicion of allergy arises. However, cases of this type appear to be quite rare.

It is advisable that experiments with this medicated cement pack be made on teeth that have to be extracted for some reason. Thus, becoming acquainted with the properties of this material, the operator can avoid undesirable experiences and the method is not unduly discredited.

CONCLUSIONS

Paraformaldehyde, mixed into a pack with zinc oxide and eugenol, is recommended as a chemical coagulant to eliminate excess gingival tissue. The use of this medicated cement pack, which is placed in the gingival crevice, causes a well-limited, sharply outlined necrosis of the free margin of the gingivae within two days. The necrotic tissue is demarcated and separated from the rest of the tissues in from four to eight days. Complete healing of the wound occurs in from ten to fourteen days after application of the pack. There is no bleeding or pain and no anesthetic is required. Repeated application of the pack is necessary if the gingiva is hypertrophic, or if the pockets are too deep.

Care should be taken that the pack does not reach below the margin of the alveolar crest, preventing necrosis and formation of a sequestrum. The medicated cement must not be packed too tightly in the pocket, to avoid stoppage of fluid seepage, which, in turn, may cause an acute inflammatory reaction, possibly abscess formation. In the case of an allergy to formaldehyde, the pack should be removed at once. No serious incident was observed in two years' use.

A thorough knowledge of the structures of the teeth and supporting tissues is essential for successful application of this as of any other method in the treatment and surgery of living tissues. The fact that the pack is easily applied, painless and self-limiting in action renders it the choice for general use.

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VARIABLE FACTORS IN THE TECHNIC OF DENTAL CASTING

By RAYMOND E. MYERS,* D.D.S., B.S., Louisville, Ky.

INTRODUCTION

COMPENSATING casting technics are based on the principle that some of the materials entering into the process must be purposely expanded in order to counteract the unavoidable contraction of certain other materials. In theory, the successful execution of this principle does not appear to be too complex, but, in practice, the difficulties associated with it are numerous and varied. Possibly the greatest factor in inhibiting success in the process is our inability to predict the exact amount of dimensional change in the materials, or, as it might be expressed in more abbreviated terms, our failure to balance the variables.

It is very likely that many scientific workers will take exception to the preceding statement on the ground that the casting shrinkage of gold alloys has been measured; that the physical and chemical properties of other materials used in the process are known, and that equipment is available for insuring execution of any desired procedure with certainty.

Without losing sight of the fact that the so-called personal equation plays an important part in the success or failure of all dental operations, it is difficult to explain why the most skilful and meticulous worker is not able to produce consistently castings of dimensional accuracy.

On the other hand, many sucessful castings have been made, both in the dental office and in the experimental laboratory, under controlled conditions, with the use of materials and technics known to be contrary to established principles.

This seems to indicate that, in spite of an increased knowledge of the whys and wherefores of the process, there are still present certain unknown variables which make results neither predictable nor explainable. It is also probable that many of the scientific data presented have not yet been utilized or correctly interpreted.

The foregoing facts, while generally recognized, are nearly always evaded by those theoretical experts who would have us believe that all the difficulties of the casting process can be solved with mathematics and expensive equipment. Presentations by these men serve only to confuse the average practitioner, who obviously has neither the time to make a study of the physical properties of dental materials nor the facilities to approach each routine casting operation as if it were a research project.

I do not mean to imply, however, that the casting of accurate fitting inlays is a hopeless task or that proficiency can be achieved in any other way than by study and the application of scientific principles.

It must, of course, be remembered that such phrases as "accurate fitting inlays" and "precision castings" are relative. For example, a specimen that is

*Professor of restorative dentistry, University of Louisville, School of Dentistry.

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regarded by one observer as poor may be considered by another as possessing a high degree of exactness. Furthermore, a great number of dentists limit their casting technic to the production of a few small inlays. Consequently, they develop a procedure that is reasonably satisfactory for these simple restorations, but one which might prove totally inadequate for more intricate designs.

a precise casting. To be sure, the success of any casting can be judged only by measuring the results and comparing these results with the purpose for which the casting was made. If it meets the requirements, it matters little how this was done or what materials were used in its fabrication. Unfortunately, only a few operators possess the required skill to convert a poor casting into a satisfac-

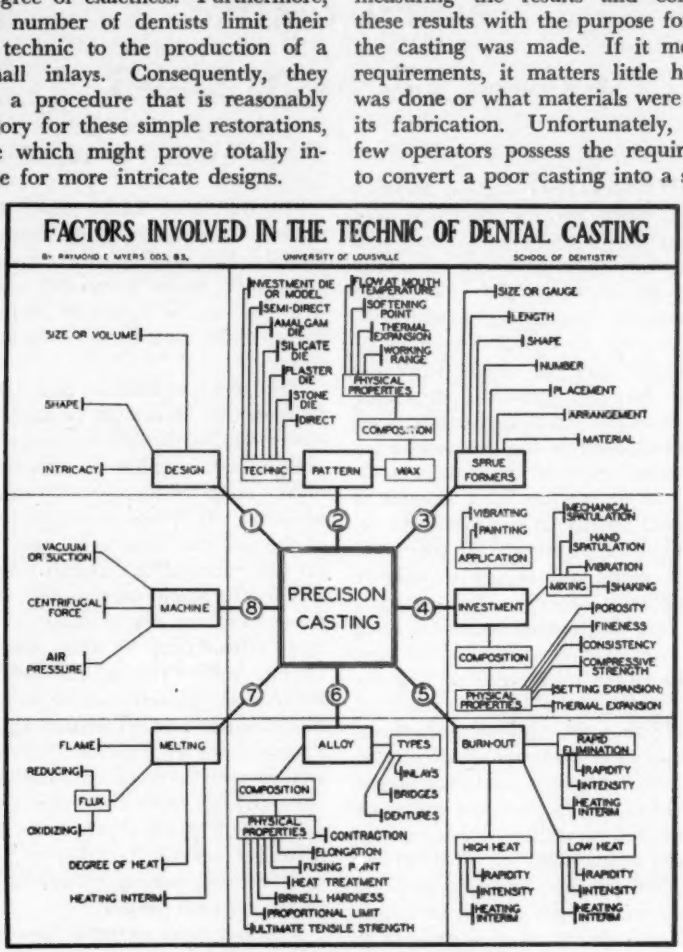

Fig. 1.—Factors in technic of dental casting.

Notwithstanding the diversity of opinion as to what constitutes a good casting and the limitation of the process by some to characteristic designs, the majority of dentists will agree that the success of the gold inlay restoration, so far as exactness is concerned, is dependent more on the ability of the operator to finish the inlay in the tooth than on his ability to make

tory one. To the man who cannot perform such a feat, I respectfully dedicate this paper. Its purpose is to discuss some of the variable factors in the technic of dental casting and to attempt to interpret certain scientific data in terms of their application to the requirements of everyday practice.

It seems desirable at the very outset to

review, briefly, the numerous factors in the process. The chart (Fig. 1) was prepared in an effort to show the enormous scope of variables, accounting for the success or failure of every casting operation. To discuss each one of these factors at this time is neither expedient nor desirable. I should rather prefer to consider the process as a whole and attempt to present only a few simple suggestions in the interest of better casting. To this end, I offer three topics for discussion: (1) control of location of the shrinkage of metal during freezing; (2) compensation for the total contraction of metal during temperature change, and (3) modifications in cavity preparation that reduce the detrimental effect of failure to balance the variables.

SHRINKAGE VALUES OF GOLD

	PRICE (DENT. COSMOS – MAR.-1911)		BUREAU (RESEARCH PAPER NO 32)	
	% LIN. CONTRACTION	% VOL. CONTRACTION	% LIN. CONTRACTION	% VOL. CONTRACTION
CHANGE OF STATE WITHOUT CHANGE OF TEMPERATURE	24 CARAT 1.64	24 CARAT 4.93	NO VALUE REPORTED	NO VALUE REPORTED
	0°C. OR (32°F.)		25°C. OR (77°F.)	
FROM FREEZING POINT 1063°C. (1945°F.) TO ⟶	24 CARAT 2.20	24 CARAT 6.60	24 CARAT 1.76 90 Au – 10 Cu 1.62	24 CARAT 5.28 90 Au – 10 Cu 4.86
TOTAL	3.84	11.53		
NET CASTING SHRINKAGE 90 Au – 10 Cu	NO VALUE REPORTED	NO VALUE REPORTED	1.25 ± 0.10	3.75

CONTROL OF LOCATION OF SHRINKAGE OF METAL DURING FREEZING

The metals used in the casting process undergo changes of volume in the form of shrinkage or contraction on cooling from the molten state to room temperature. This natural phenomenon creates two major problems in the production of satisfactory restorations. One problem is concerned with the matter of compensating for the shrinkage of the metal to insure dimensional accuracy; the other involves the elimination of porosity in the metal to insure strength and surface perfection. Any attempt to solve these problems must be preceded by a knowledge of the magnitude of the contraction and an understanding of its effects on the finished restoration.

For purposes of study, the contraction of gold may be divided into two stages: (1) contraction of the metal during solidification and (2) contraction of the solid metal on cooling from the freezing point to room temperature.

In 1910, Price[1] measured the shrinkage of gold in a fused quartz mold. The values he reported were 1.64 per cent linear contraction due to change of state without change of temperature (i.e., from liquid to solid), and 2.20 per cent linear contraction from the freezing point 1.945° F. to 32° F. These values are presented in the accompanying table. Price concludes that part of the contraction of gold during casting may

be compensated by the addition of molten gold from the sprue. Regarding the control of the site of this area of contraction of gold, he says:

Probably no dentist who has done casting has failed to see that frequently there was a hole or depression in the side of the casting, or even a complete separation between the sprue and the inlay. This is the result or expression of the contraction due to change of state; it is, however, an error that we can control entirely. While we cannot prevent contraction due to change of state, we can control its location. In other words, we can, by forcing in molten gold from the sprue to take the place of the accumulated contraction in the inlay, cause all the contraction

Fig. 2.—Two castings made in same mold. The only difference in the designs is the addition of a reservoir to one of the patterns.

due to change of state to appear in the sprue. This can only be done by having the gold in the sprue molten while that in the inlay is crystallized, which can best be secured by having the mass of gold in the sprue large in proportion to the inlay, and by using a high enough pressure to move the gold in; also by using a relatively large gate, and having the investment heated sufficiently so that the gold will not be quickly chilled in the gate.

Until more recent times, few people appreciated the significance of Price's classical experiment or realized the truth of the pertinent remarks just quoted.

In 1928, Coleman,[2] at the National Bureau of Standards, measured the linear thermal contraction of pure gold and coin gold during cooling from the melting point to room temperatures. These values are also given in the table. It will be observed that Coleman made no measurement of the contraction of gold during the change of state at constant temperature. He did measure the net casting shrinkage of an alloy of 90 per cent gold and 10 per cent copper after casting in a dental investment mold. This value he reported as 1.25 per cent linear contraction, whereas the thermal contraction of the solid metal was 1.62 per cent.

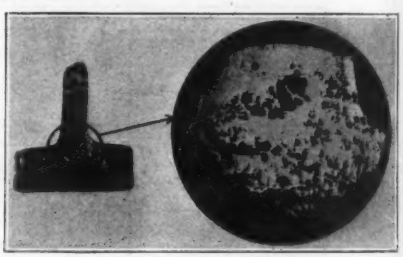

Fig. 3.—Photomicrograph of section of casting made without reservoir; showing localized shrinkage.

Coleman suggests two possible explanations of this difference:

(1) There may be sufficient friction or interlocking between the casting and the walls of the mold to hold and stretch the casting while it is cooling through that range of temperature within which the metal is very soft and weak, thus preventing the full normal shrinkage, and (2) the compensation of part of the total shrinkage of the solid metal may be dependent upon a difference in the rates of cooling of different parts of the casting. If part of the metal in the mold solidifies and cools to some temperature below the melting point before the metal in the sprue freezes, the shrinkage due to the cooling of this solid metal may be compensated by the addition of metal from the crucible.

The shrinkage of the liquid metal before the sprue freezes obviously would be compensated by the addition of metal from the crucible if the casting pressure were maintained. If a crust of solid metal has formed around the outside surface of the casting before the central part of the casting freezes, the shrinkage of this central portion as it cools to the freezing point may produce voids or porosity previously referred to as localized shrinkage in the casting. Such localized shrinkage would not affect the outside dimensions of the casting.

In the case of shorter, bulkier castings the stretching force of the mold might not have so great an effect. The addition of more metal from the crucible would be less effective because of the relatively faster rate of freezing of the metal in the sprue. The shrinkage of such castings would probably be slightly greater than the values reported.

In the last paragraph, Coleman seems to imply that the measurements of the net casting shrinkage of gold were made under casting conditions that were effective in compensating for the contraction of metal during solidification.

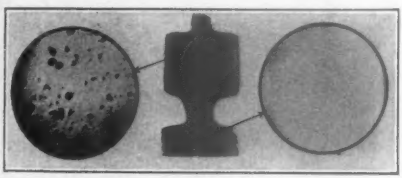

Fig. 4.—Photomicrograph of section of casting with attached reservoir; showing localized shrinkage in reservoir while the casting proper is relatively free of porosity.

It would be interesting to know whether the value for the net casting shrinkage of gold alloys would be materially changed if measurements were made when the shrinkage due to change of state is not compensated; i.e., when the casting pressure is not maintained or when the metal in the sprue is allowed to solidify before the casting proper, thus preventing the latter from drawing additional metal from the crucible.

Notwithstanding the universal acceptance of Coleman's value for net casting shrinkage and the excellence of his ingenious experiment, there is considerable evidence, based on practical experience, that the magnitude of shrinkage of gold alloys varies rather considerably, depending on certain casting conditions. For example, such experiments as those reported by Meyer[3] in 1926 present evidence to the effect that thin three-quarter crowns show less binding because of shrinkage than bulky ones and that mesioclusodistal inlays shrink more when the occlusal part is bulky than they do when the occlusal part is thin.

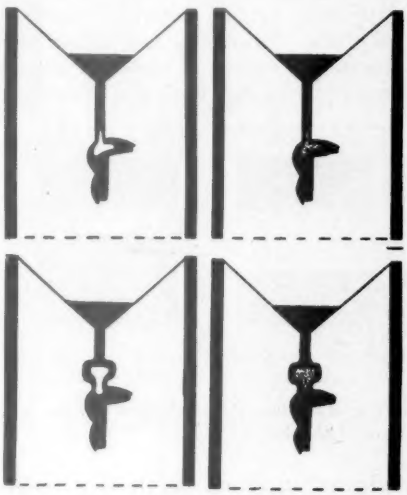

Fig. 5.—Sprueing to prevent "shrink-spot" porosity. White areas in the drawings on the left indicate that gold is still molten. Dotted areas in the drawings on the right represent porosity in the gold after solidification. (Ney Gold Handbook.)

Campbell[4] believes that "alteration of the sprue position with regard to the mass of gold can cause variation in results by shifting the point to which the contraction takes place"; and Scheu[5] is of the opinion that the magnitude of the shrinkage may vary with different gold alloys.

But whether it can be proved that localized shrinkage in the casting occurring during solidification can affect the dimensional accuracy of the restoration, there is no question that it does produce internal porosity and surface imperfections in the metal. This fact alone is sufficient justification for the use of any means available to insure that at least a part of the shrinkage of the metal on solidification will not appear in the casting proper.

This can easily be done, as has already been pointed out, by insuring that the metal in the sprue will remain molten while that in the pattern chamber is solidifying. Since it is not always possible to use sprues of sufficient size to supply the casting during solidification, filling the reservoir shall remain molten after the casting has solidified, thus serving to feed additional molten metal to the casting as it shrinks during solidification.

Figure 2 shows two castings which were made at the same time under identical conditions with respect to casting technic. The only difference in the two designs is the addition of a reservoir to one of the patterns. Both castings were sectioned through the sprue and polished for microscopic examination.

A photomicrograph of the section of the casting made without the reservoir (Fig. 3) shows a considerable amount of localized shrinkage.

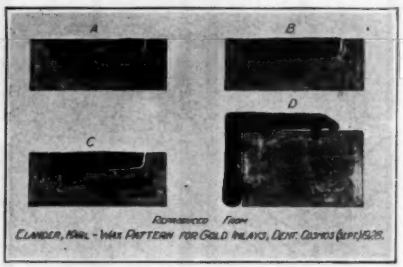

Fig. 6.—Dimensional changes in wax patterns. (Elander.)

Fig. 7.—Casting flask with asbestos liner.

Coleman[2] suggested the use of reservoirs as a means of reducing "shrink-spot" porosity. He reported experiments to prove that the use of properly designed reservoirs resulted in castings that were as sound near the sprue as elsewhere.

In dental casting, the reservoir is easily provided by attaching a ball of wax to the sprue at a point close to the wax pattern. Its volume should be greater than the portion of the pattern to which it is attached and the connection between the reservoir and the pattern should be thickened by the addition of wax.

Adherence to these specifications is essential to insure that the mass of metal

A photomicrograph of the section of the other casting with its attached reservoir (Fig. 4) shows localized shrinkage in the reservoir, while the casting proper is relatively free of internal porosity.

The manner in which shrink-spot porosity occurs during freezing of the metal is illustrated in Figure 5. The white areas represent the last portion of the metal to congeal. Thus, with the use of reservoirs, the porosity is concentrated harmlessly outside the casting proper.

Before leaving the subject of casting shrinkage, it should be pointed out that

the figure 1.25 is a percentage value of linear dimension. In other words, gold during casting shrinks 1.25 per cent of its length. This means that the magnitude of contraction of a long design will be greater than that of a short one. For example, 1.25 per cent of 10 feet is more than 1 inch, whereas 1.25 per cent of 4 mm. is only 0.05 mm. Thus, in dental practice, the discrepancies in a restoration of small dimensions may be unobserved, while those in larger designs will often be obvious and irremediable.

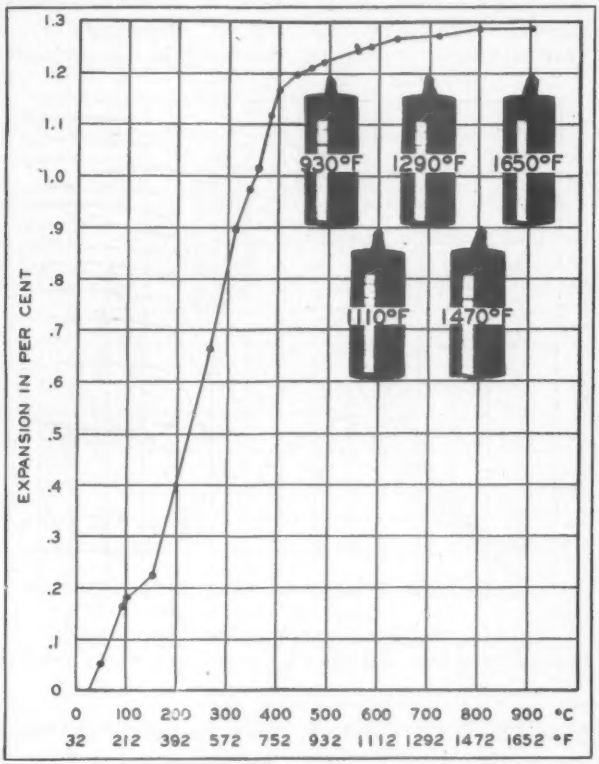

Fig. 8.—Thermal expansion curve, cristobalite investment. (Volland and Paffenbarger.)

COMPENSATION FOR THE TOTAL CONTRACTION OF METAL DURING TEMPERATURE CHANGE

Wax Expansion.—In view of the fact that the various materials entering into the process of casting are subject to expansion and contraction, a method of balancing these dimensional changes is essential to the production of accurately fitting inlays. As in balancing a ledger, every contraction must be overcome by a counteracting expansion. The magnitude of the dimensional changes will vary with the type of materials selected and with the manner in which each one is manipulated. Another complication arises from the fact that the combination of variables will differ, depending on whether the casting is made by the direct or the indirect method. It would be well to consider some of these materials, with the realization that a knowledge of their

behavior will contribute to increased proficiency in the practice of dental casting.

The principle of compensation was first presented to the dental profession by Van Horn[6] in 1910. He later[7] called attention to the fact that "no cast gold inlay technic can possibly reach the maximum in efficiency unless zero dimension, i.e., the point from which dimensional changes (+ or −) are calculated, is placed at tooth cavity temperature." This statement applies to laboratory, zero dimension will begin at room temperature.

The question might logically be asked: Why not chill the wax pattern in the tooth cavity in the mouth so that it will be in adaptation to the cavity walls at room temperature? The feasibility of this procedure was determined by Taylor and Paffenbarger[8] at the Bureau of Standards in 1930. They measured the effect of the use of cold water in reducing the temperature of a wax pattern contained in an occlusal cavity of a

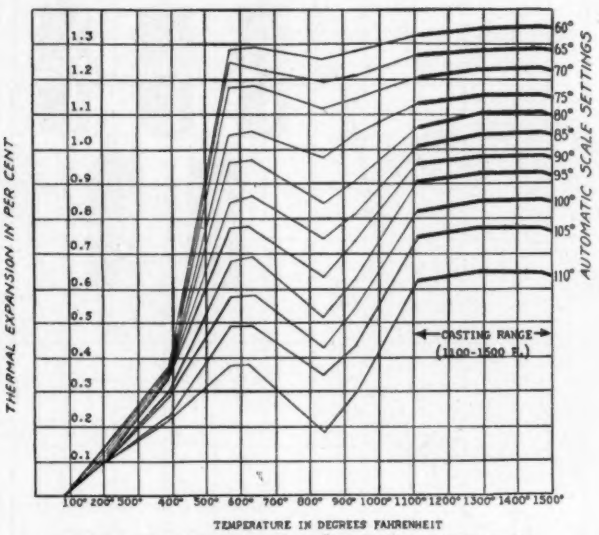

Fig. 9.—Thermal expansion curves of "control" investments. (Phillips.)

both the direct and the indirect methods and simply means that when a direct wax pattern or an indirect impression is made in the mouth, the material is in adaptation to the walls and margins of the cavity at mouth temperature; consequently, on being removed from the mouth and subjected to a change in temperature, the material will exhibit a corresponding change in dimensions. On the other hand, if a casting is to be made for a steel die or extracted tooth in the lower first molar and concluded that it was impractical to adapt the wax pattern to cavity detail at room temperature.

This conclusion, however, should not be applied to modeling compound impressions employed in the indirect method. Crawford[9] has shown that tap water at a temperature of approximately 55° F. will cool the modeling compound impression to room temperature (70° F.) or considerably below in two or three

minutes. The possible explanation of this difference between the behavior of wax and of compound is the fact that modeling compound contained in a copper band and extending above the occlusal surface of the tooth can be more easily chilled with water at a given temperature than a wax pattern can when it is surrounded by tooth structure on five sides. It would seem that this fact necessary temperature control, to say nothing of the impracticability of the operator's working in a room registering 98° F., makes this procedure obviously unfeasible.

It remains evident, therefore, that any dimensional changes in the wax pattern from mouth temperature to room temperature must be included in the list of items for compensation.

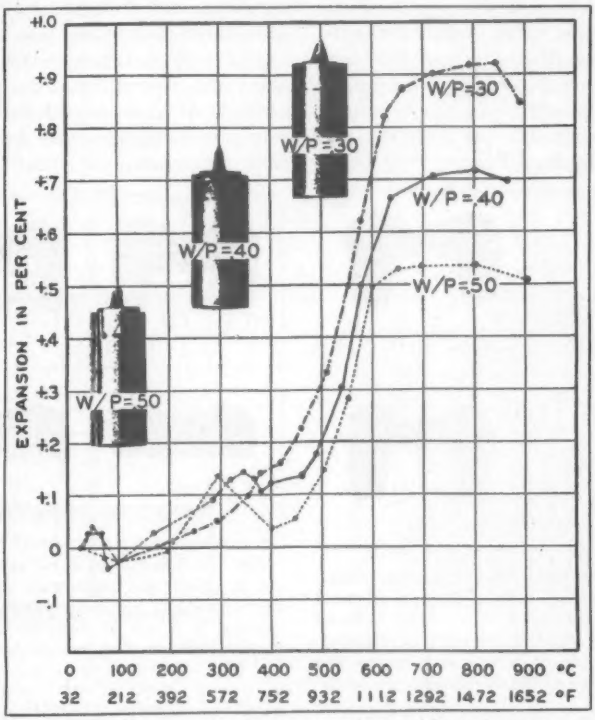

Fig. 10.—Thermal expansion curves, 20 per cent plaster-of-Paris investment. (Volland and Paffenbarger.)

offers a point in favor of the indirect method in that it lessens the degree of compensation required for wax patterns made directly in the tooth cavity in the mouth.

Another suggestion for preventing the shrinkage of the wax is maintenance of the pattern at 98° F. But the difficulty of providing a special room with the

The first attempt to counteract this shrinkage of the wax pattern, as well as to assist in compensating for the contraction of the gold alloy, was to expand the wax pattern after it was removed from the cavity. But the results of scientific investigation and practical experience have taught us that this procedure is no longer necessary and, because of the

danger of distortion of the pattern, is contraindicated.

Price,[1] in 1911, demonstrated the elastic property of waxes with a simple experiment as follows: Two sticks of commercial inlay wax were rendered plastic by heat. One was stretched and chilled; the other was compressed endwise and chilled. The sticks were then cut to the same length and measured. After being left in a warm part of the room overnight, they were measured again. The stretched one had shortened about 6 per cent and the compressed one had lengthened about 4.5 per cent.

The distortion of wax patterns was also studied by Karl Elander,[10] of Gothenburg, Sweden, in 1928. He prepared notches in bone slabs to represent cavity preparations. These notches were polished, then lubricated and filled with wax. A reproduction of his drawings is presented in Figure 6.

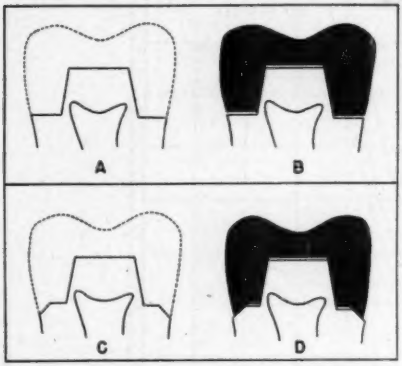

Fig. 11.—Sectional drawings representing shrinkage of mesioclusodistal designs. B shows the effect of shrinkage in a cavity without bevels on the gingival cavosurface margins. D shows the use of bevels in reducing the detrimental effect of the shrinkage.

Maves,[11] in 1932, and Lasater,[12] in 1940, presented proof of the distortion of mesioclusodistal wax patterns. The pattern for inspection was suspended in a water bath and an enlarged image was projected on a screen. The temperature of the bath was varied, and the outline of the projected image was traced at each temperature. The tracings were then superimposed on one another. Lasater discovered a relation between the temperature at which wax is manipulated and the amount and type of distortion occurring upon heating. For example, when the wax was poured into the matrix on the model in the liquid condition and chilled under pressure, the subsequent distortion was less (below 115° F.) than it was when the plastic wax was forced into the cavity and chilled. He also found that when the wax was manipulated at the lowest possible temperature at which it could be used successfully (125° F.), no change whatever in shape took place until the pattern was heated to within the neighborhood of the temperature at which it was manipulated. It is interesting to note that the temperature range wherein no change in dimension took place was between room temperature and mouth temperature.

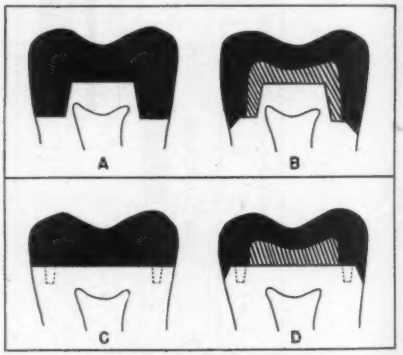

Fig. 12.—Sectional drawings representing use of bevels and uniformity of thickness in mesioclusodistal and onlay designs. The shaded portions in B and D show the amount of reduction in the bulk of the castings.

It was also concluded from these investigations that distortion during and after removal of the wax pattern is decidedly reduced by using multiple

sprues for complex inlays and that, if the pattern is broken during removal or before investing, it may not be repaired without the possibility of serious distortion resulting. The only safe procedure is to make a new pattern.

Taylor,[13] in reporting experiments to show the effect of applying pressure to the wax before and during cooling, says, "These observations would seem to suggest that compression of the wax should reduce the contraction from mouth to room temperature, whereas no compression should tend to increase this contraction, since strains would be relieved to some extent in cooling, as they were during heating."

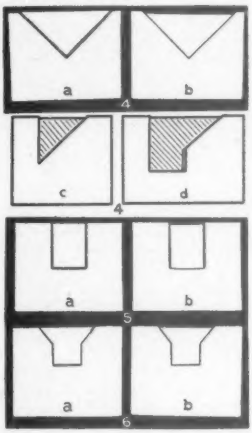

Fig. 13.—4 a, b, c and d, diagrams of cone-shaped cavities wherein contraction of gold casting would not prevent casting from going to place. 5 a and b, same as 4, but for cylindrical cavities. 6 a and b, same as 4 and 5, but for a combination of conical and cylindrical types of cavity. (Solbrig.)

Investment Setting Expansion.—The foregoing facts offer considerable proof to the effect that thermal wax expansion as a means of compensating for the contraction of gold alloys is a questionable procedure and should, if possible, be avoided.

Fortunately, investment materials are now available, the combined setting and thermal expansion of which is adequate to compensate for gold contraction without the addition of thermal wax expansion. Hence, the study of investment materials takes on added importance, since a knowledge of their behavior furnishes the key to success in present-day casting practice.

All investments contain plaster or hydrocal as a binder and this ingredient causes the material to expand upon setting. For most investments, the setting expansion is approximately between 0.1 and 0.5 per cent. The value for each investment, having been previously determined by the manufacturer, is generally indicated on the container.

Fig. 14.—Mesioclusal cavity for cast gold inlay; showing accentuated bevels on cavo-surface margins.

If the investment is not confined in a ring or otherwise resisted, most of the setting expansion will take place equally in all directions. Thus, in a dental investment mold, the pattern chamber would become larger than the original wax pattern, and this change in dimensions of the cavity would aid in compensating for the contraction of the gold. But if the investment material is confined in a metal ring, uniform expansion cannot take place. The unyielding ring will

allow the setting expansion to proceed in one direction only; i.e., endwise, resulting in a distortion of the pattern chamber.

Various suggestions have been made for averting this difficulty and providing for unrestricted setting expansion. Possibly the most satisfactory and convenient solution of the problem is the procedure of lining the inside of the casting ring with a strip of asbestos sheet. The asbestos liner acts as a cushion, allowing some setting expansion to take place laterally. It also makes allowance for the thermal expansion of the investment, which is, in certain cases, greater than the thermal expansion of the metal ring.[16]

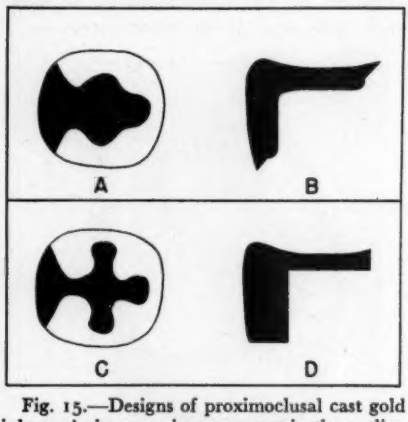

Fig. 15.—Designs of proximoclusal cast gold inlays. A shows an improvement in the outline form over that in C. B shows the section of an inlay with uniform thickness, accentuated bevels and rounded cavosurface angles. These desirable features are absent in D.

Unfortunately, however, setting expansion of the investment material is also resisted by the invested wax pattern, particularly with such types as three-quarter crowns and mesioclusodistal inlays. Skinner[14] and Taylor[13] have studied the effect of this confinement of the setting expansion of the investment by wax patterns. As a result of these investigations, Skinner has designated the term "normal setting expansion" to describe the dimensional change that takes place under conditions of complete freedom of movement, and "effective setting expansion" for that which is actually utilized in compensation.

Since the effective setting expansion is always less than the normal setting expansion, the value indicated on the container by the manufacturer is somewhat misleading and should not be interpreted as a measure of compensation.

Crawford[9] is of the opinion that "when the single-investment method is employed, the setting expansion does not affect the size of the casting—at least not to the extent to be of any particular significance." On the other hand, he says, as does Shell[15] and others, that when the double-investment technic is used, the effect of setting expansion on the size of the casting can be demonstrated.

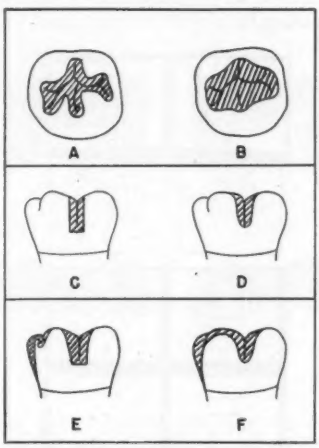

Fig. 16.—Outline forms of cavity preparations for cast gold inlays. B, D and F show the avoidance of irregular angles and sharp curves, which are improvements over those designs represented in A, C and E.

To be effective, the asbestos strip should be placed loosely in the ring and should be long enough to extend about one and one-half times around the ring.

The liner should be wet to prevent the dry asbestos from absorbing water from the investment mix after it is poured into the ring. When a pressure machine is used, the asbestos liner should be cut about one-eighth inch short of the ring at the top and bottom to allow the investment to contact the ring at these points and to prevent the escape of air beween the investment and the ring. A casting flask with the asbestos liner prepared in this manner is shown in Figure 7.

Investment Thermal Expansion.—In the early days of dental casting, the primary purpose of heating the investment material was to eliminate the wax from the mold in preparation for the reception of the gold. In the belief that the accompanying rise in temperature was objectionable, the customary procedure was to allow the mold to cool to room temperature before making the casting.

Today, we are aware of the necessity of heating the mold with the object of expanding the investment material as a means of compensating for the contraction of the gold alloy. There is much experimental evidence that the thermal expansion of the investment is the largest contributor to compensation and, when properly executed, is the safest procedure.

Before the advent of cristobalite[17, 18] as a substitute for quartz, it was difficult, if not impossible, to obtain adequate compensation for all types of castings by means of investment expansion alone. Moreover, it was unfortunate that most of the investments studied at the Bureau of Standards in 1928 showed erratic behavior during heating, as was indicated by their thermal expansion curves.[2]

Figure 8 shows the thermal expansion curve of a cristobalite investment that will give adequate compensation for the contraction of gold without the addition of either wax expansion or investment setting expansion.

As a matter of fact, the magnitude of the expansion is too great for certain types of castings. This led Phillips[19] to develop a method of controlling the thermal expansion by combining two investments in proper proportions: one with a lower thermal expansion and another with a high thermal expansion. The scales for measuring the investment powders was graduated in such a manner that varying proportions of cristobalite and "control powder" were obtained. In this manner, the gradual increase in the proportion of cristobalite allowed the thermal expansion to vary from about 0.7 to 1.4 per cent. Curves of these expansions are shown in Figure 9.

Another means of controlling the thermal expansion of the investment material is to vary the water: powder ratio of the mix. Figure 10 shows the effect of using 30, 40 and 50 cc. of water for each hundred grams of powder. At temperatures above 1100° F., this variation in the thickness of the mix is perceptible. Thus, more expansion at any given temperature can be obtained by decreasing the amount of mixing water.

Varying the temperature to which the investment is heated is not a very safe procedure for controlling thermal expansion, unless satisfactory temperature regulating equipment is available. It can be observed from any of these curves that the thermal expansion value increases quite rapidly until the maximum is reached. Hence, it would be difficult to determine the temperature of the investment at different intervals.

It is fortunate, on the other hand, that the thermal expansion curves remain fairly constant for a period of several hundred degrees beyond the temperature of maximum expansion. The latter temperature, which is approximately 1300° F., is indicated by a red glow in the sprue hole under shaded light. Since this color observation is sufficiently accurate for determining the casting temperature, expensive pyrometer-controlled equipment is not required. It matters little

whether this temperature is reached in a $500 furnace or with a $5 blowpipe. Furthermore, if the temperature exceeds this maximum value, no harm is done. It is important to understand, however, that once the proper casting temperature is reached, the mold should be maintained at this temperature until after the casting is made. With most investments, the thermal contraction to room temperature, after being heated to 1300° F., is greater than the thermal expansion to this temperature.[20] Studies by Skinner[21] comparing the investment thermal contraction curves with time-temperature cooling curves of the mold obtained under conditions of inlay casting procedure indicate that little or no thermal contraction occurs within the first minute after removal of the mold from the furnace at a temperature of approximately 1300° F. The permissible time for casting will, of course, be somewhat extended in the case of large castings because of the increased bulk of investment, which provides greater insulation for the mold.

It was pointed out in the preceding discussion of the physical properties of investment materials that any degree of expansion can be obtained by investment manipulation, but no answer was proposed to the question, How much expansion do we need? If correct compensatory expansion for all types of castings, irrespective of their size and shape, could be based on the percentage value of 1.25 for the linear contraction of gold, the problem would not be a difficult one. Practical and experimental results of varied casting technics demonstrate the fallacy of such an assumption.

In the words of Phillips,[19]

> Countless tests have dictated that more than average investment expansion be employed to secure correct adaptation for full molar crowns, all one-surface castings and large mesioclusodistal molar castings. Three-quarter crowns for anterior teeth require "underexpansion" for a comparable fit.

Crawford[9] writes,

> The problem of choosing the proper amount of expansion is a matter of experimentation. . . . Although the contraction of gold is established at approximately 1.25 per cent, all castings do not fit equally well when cast to compensate for exactly this amount of contraction. Some require slightly more and some slightly less.

Campbell[4] is of the opinion that true dimensional accuracy cannot be reliably obtained by casting. He says, "The next best thing is to produce as fine and as accurate a casting as possible, but with a known and definite difference in its dimensions to the plus or to the minus side."

These statements, which are representative of hundreds of opinions, are quoted here as a prelude to the last portion of this paper.

MODIFICATIONS IN CAVITY PREPARATION TO REDUCE THE EFFECT OF FAILURE TO BALANCE THE VARIABLES

In view of our inability to produce consistently castings of dimensional accuracy in the dental office, we have at our disposal one means of overcoming, at least to some extent, the discrepancies that result from failure to balance the variables. This is simply the opportunity to make certain changes or modifications in cavity preparation for gold inlays to allow an inlay, although of slightly inaccurate dimensions, to protect the tooth for a long time against recurrent caries.

The principles of Black's cavity preparation were based on the concept of adequate resistance and retention form in proportion to the strength of the filling material to be used. Since these forms were originally designed to meet the requirements of gold foil, it does not necessarily follow that they are ideal for cast gold inlays.

With the advent of so-called hard golds, the requirements of strength have been met with considerable reduction in the bulk of the restoration. This change

has contributed not only to conservation of dental pulps, but also to the facility with which castings of dimensional accuracy can be produced. It is not difficult to prove by experiment the proposition that thin castings are easier to fit than bulky ones and it is probably the most important requisite to success in the entire scope of the casting process.

In a mesioclusodistal design, such as that illustrated in Figure 11A, the shrinkage of the gold will reduce the dimensions of the casting in all directions; namely, mesiodistal, buccolingual and occlusogingival. The resulting discrepancies would be apparent in the finished restoration in a heavy cement line at the margins. This shortage on the gingival walls is represented in B. Sectional drawings C and D show the use of bevels on the gingival cavosurface margins in reducing the detrimental effect of the shrinkage.

Moreover, the likelihood of failure to approach dimensional precision in this type of restoration will be considerably lessened by a little additional effort in providing for uniform thickness with minimum bulk. In Figure 12, B shows an improvement in the design over that in A. The shaded portion represents the amount of reduction in the thickness of the casting. Similarly, the drawings in C and D illustrate the application of the principles of bevels and reduced bulk to one of the most difficult castings in dentistry; namely, that of an onlay, which, incidentally, is used frequently in mouth reconstruction.

Possibly the most satisfactory method of reducing the bulk of the restoration is the placement of cement or other capping material in the cavity. But good results may also be assured by removing a portion of the materials from the cavosurfaces of a direct wax pattern or of an indirect compound impression. Again, many operators who are adherents of the indirect method prefer to build up the walls of the die cavity with some material, such as moldine, plaster and amalgam.

The principle of using accentuated bevels or flares to reduce the detrimental effect of shrinkage in cast inlays was suggested by Solbrig[22] in 1929. His diagrams (Figure 13) show the effect of shrinkage of castings when placed in the cavities for which they were made. It may be observed in 5a and b that shrinkage of inlays in cylindrical type cavities without cavosurface bevels will result in a shortening of the casting at the top as well as in a space between the inlay and the cavity. On the other hand, when an accentuated bevel or flare is placed on the cavosurface margins, shrinkage of the casting will result in a shortening at the top, but not between the inlay and the cavity. A slight grinding of the enamel would correct this difficulty and assure a useful inlay.

While few inlays are strictly cylindrical in form, the principles propounded by Solbrig are, nevertheless, applicable to all types of inlays and, in a limited measure, will serve to reduce the detrimental effects of failure to compensate completely for the shrinkage of gold.

Figure 14 shows the application of these principles to a mesioclusal cavity in a lower first molar. In addition to the accentuated bevels on the occlusal and gingival cavosurface margins, the buccal and lingual walls of the proximal portion are strongly flared toward the buccal and lingual surfaces, respectively. Also, the buccal and lingual walls of the proximal portion diverge toward the occlusal surface, and the line angles of the interior of the cavity are rounded.

An occlusal view of the outline form of a restoration in this type of cavity is shown in Figure 15A, and a mesiodistal section of the restoration in B. By contrast, C shows an improper outline form with abrupt curves, and a constriction between the proximal and occlusal parts. The mesiodistal section of this restoration, D, shows a bulky proximal part and

a thin occlusal part. There was no bevel on the gingival or occlusal cavosurface margins and the line angles of the interior of the cavity were sharp. Slight discrepancies in the dimensional accuracy of castings made according to these designs will be more pronounced in D than in B.

The importance of the factor just alluded to, with respect to the rounding of the outline form of the cavosurface and the avoidance of irregular angles or sharp curves, is illustrated in three forms in Figure 16. A represents the customary outline form recommended for foil or amalgam, while B represents a modification that is conducive to a better fit with the cast gold inlay. It should be pointed out that the outline represented in B indicates the extent of the cavosurface bevels and not of the walls of the cavity. C and D represent the wrong and right outline forms, respectively, of buccal or lingual extensions from occlusal restorations. E shows an irregular outline of the extensions of a distoclusal restoration into the buccal and distobuccal grooves of a lower first molar. In this type of restoration, it is better to reduce both the distobuccal and the distal cusps sufficiently to allow a smooth curve to join the proximal part of the restoration with the extension into the buccal groove, as illustrated in F.

SUMMARY

The factors in the technic of dental casting are variable in the hands of the individual, and the efficacy of the process in the practice of dentistry depends on the successful manipulation of the materials involved, whether it is done by reasoning or by accident.

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DENTISTRY IN CHINA—PAST AND PRESENT

By David S. K. Dai, D.D.S., Ann Arbor, Mich.

IT is of interest that the first three emperors of authentic Chinese history, Fu Hsi (2953 B.C.), Shen Nung (2838 B.C.) and Huang Ti (2698 B.C.), and the first president of the Republic of China, Sun Yat-Sen, were all practitioners of the healing art. Fu Hsi advocated a cosmic philosophy. He believed that the universe is a unity and yet, at the same time, is made up of dual opposing forces. He is closely associated with the metaphysical side of medicine and is also honored as the first to bring to the profession an understanding of the pulse as a diagnostic aid. Shen Nung examined and classified most of the medicinal herbs and established the foundation of classical Chinese medicine. Huang Ti fostered the application of sound methods of diagnosis. He is the symbol of the increasing reliance of the physician on the behavior of the pulse. He also introduced physical therapy, including massage, the use of the moxa, enemas and graded exercise, and recommended the use of mineral and organic medicaments, as well as visits to hot spring and mountain sanatoria for treatment by rest and sunlight. The medical book written by him, "The Internal Classics," is the oldest as well as the greatest of the Chinese medical classics.

Emperor Huang Ti was probably the first Chinese to study dental disease. He divided oral diseases into three types: (1) Fong Ya, or inflammatory conditions; (2) Ya Kan, or diseases of the soft investing tissues, and (3) Chong Ya, or dental caries. According to him, oral disease and pain were the result of an imbalance of body heat and cold, and mobility of the teeth resulted from inflammatory conditions. He believed that the teeth were a type of skeletal tissue and, therefore, that anything beneficial to the formation of bone was helpful to them. Thus, the horn of the deer was considered an excellent medicament for diseased teeth.

Chong Ya (worm tooth), or dental caries, was attributed to the gnawing of worms and could be prevented by the removal of food débris from the mouth after eating. So widespread is this belief among present-day Chinese that the custom of rinsing the mouth is the common practice in their country. Rampant caries of childhood, Chiao Ya (burned tooth), was considered to be the result of overindulgence in sweets, an opinion widely held by Chinese parents today.

Therapeutic measures were largely confined to prescribing internal draughts of drugs designed to combat abnormal changes of the body and to strengthen the internal organs. Local treatment included acupuncture, the use of the moxa (counter irritation), massage and application of medical plasters to reduce inflammatory conditions and to relieve pain. Available records indicate that the Chinese people began to brush their teeth and rinse their mouths with saline solutions during the Tang Dynasty, about 619 A.D. Unfortunately, no attempt was made by the Chinese physician to repair the damaged tooth. There is no evidence of a restorative art and nothing concerning it can be found in Chinese medical literature.

Chinese proverbs and folklore contain

From the Division of Dental Research, School of Medicine and Dentistry, University of Rochester.

much that is of interest to dentistry. The relationship of dental to systemic health has been emphasized in the proverb of Confucius that says "Disease enters by mouth," and every Chinese schoolboy is acquainted with the proverbial "Ten thousand diseases arise from the mouth." The ancient poets and storytellers thought a great deal about the teeth. They usually described the teeth of princes as being regular and white, likening them to melon seeds or the heart of the cherry. Ghosts were mentioned as having teeth "as sharp as knives, very long and irregular." Fortunetellers told a person's fortune, life and character by the appearance of the teeth and the development of the mandible.

A perspective of the changes and developments of dentistry in China can be obtained from a consideration of that country's dental history in evolutional phases.

PREPROFESSIONAL EPOCH

Until a few years ago, women who made their living by removing "tooth worms" were found in the rural districts of the interior provinces. With the aid of sleight-of-hand, the "worm remover" presented to her client a worm, or worms, according to the fee agreed upon. The aching tooth was usually at least temporarily relieved by placing a lime cement in the cavity, ostensibly to prevent the entrance of more worms, but it appears that the power of suggestion was the only therapy considered necessary to produce the cure.

The old style "tooth remover" flourished in ancient rural China. Only those teeth that had been loosened by chronic or acute inflammatory conditions received his attention. Frequently, he was found in busy market places, with herb sellers, phrenologists, fortunetellers and the like. His stand could be identified by piles or strings of extracted teeth, which were supposed to attest his skill as an extractor. Today, the group to which he belonged has been replaced by younger men, who follow much the same methods of practice, but have increased their equipment by Western style tooth forceps and often outdo their elders by rubbing some anesthetic, usually cocaine, on the gums about the teeth to be extracted. As yet, no estimate can be made of the number of these so-called "modern tooth removers."

There is also an interesting group made up of "tooth cleaners." They attend county fairs and, as a rule, their charge for dental cleaning is a very small one. Their technic, although crude, is rapid and seemingly quite effective, for the teeth are usually clean and white after their treatment. The cleaning mixture is composed of a dilute solution of hydrochloric acid, which dissolves the outer enamel surface, leaving it rough and probably more susceptible to caries and the accumulation of stains.

Still another group consists of those persons who are ordinarily housed in rooms with windows opening directly on the street and who display signs announcing them to be "tooth-fitters." They offer to restore lost teeth by full or partial dentures, to cover decayed areas with a more or less toothshaped cap of gold, brass or silver, or to cater to the human desire for adornment by capping perfectly good anterior teeth. Some attempt to fill tooth cavities with a cement, guttapercha or locally made silver alloy. It has been estimated that, throughout China, they number at least 5,000. According to my survey under the auspices of the Municipal Government of Chengtu, there were thirty-nine such dental shops in that city in 1934.

In the large and more up-to-date cities, there are to be found a group of men in practice who formerly served as chair and laboratory assistants to Japanese, European and American dentists. These men offer a little better grade of practice than the last mentioned. Because their treatments are based on unreasoned observa-

tion, they can do no more than produce mechanical results without a consideration of the biologic factors involved. Therefore, their activities are at times a menace to public welfare.

INTRODUCTION OF SCIENTIFIC DENTISTRY

There are in a number of the open ports of China, European, American and Chinese dentists who have been educated abroad. Unfortunately, these men confine their practices largely to the well-to-do and, as a result, have done little or nothing for the advancement of dental practice or the development of dental education in China.

Pioneer western dentists, including Anderson, of Yale, Yates, of Harvard, Halliday, of Columbia, and Canadian dental teachers (Thompson, Lindsay, Agnew, Mullett and Campbell), have succeeded in introducing modern dentistry into China. Several unsuccessful attempts to establish schools have been recorded. A group of foreign-trained Chinese dentists opened a three-year course dental college in Shanghai in 1930. This school existed for only three years and graduated less than twenty men. The Peiping Methodist Hospital also conducted a three-year course in dentistry for a number of years beginning in 1917.

The first successful dental school in China is that associatd with the West China Union University located at Chengtu, Szechwan. The dental faculty was created in 1914, and in 1929 was united with the faculty of medicine to form the College of Medicine and Dentistry. The founder of that school is Ashley W. Lindsay. The educational program has been unceasingly promoted by Thompson, Agnew, Yates, Mullett, Campbell and the founder.

The college offers a university-grade dental education through a curriculum that may be completed in seven years after high school graduation. The biologic and medical science courses are taught to medical and dental students in the same classes and laboratories, and by the same staff. Its graduates are granted the D.D.S. degree and are finding ready employment all over China. It is hoped that they will be of great service in meeting the wide demand for practitioners and leaders of dental education.

In the fall of 1935, the National Government organized a department of dentistry in the National Central University at Nanking. The course was given in four years, including predental study. However, on removal to Chengtu in 1937, the great difference in standards between the West China Union University and the National Central University Schools of Dentistry caused dissatisfaction among the students of the latter institution. As a result, the dean of the National Central School resigned and the school underwent reorganization. On the recommendation of the Ministry of Education, a six-year course in dentistry for the National School was agreed upon.

In the spring of 1937, the first meeting of the initial committee on dental education recommended that the government base future dental practice on the principle of prevention. Further, the committee recommended training a dental personnel that could put into operation the preventive principle. The necessity for this stand is obvious when China's tremendous population is compared with its extremely small number of adequately trained practitioners.

INSTITUTION OF PUBLIC HEALTH DENTISTRY

Dentistry in China has made rapid progress as a public health service during recent years. The public health program of the National Government demands preventive dental services in the schools, in the municipal health clinics and in the army, and an ever-increasing number of clinics are being organized and put into operation. Most of the larger general and military hospitals have dental departments with qualified dental surgeons in attendance. To date, such facilities

have been extended to the border of Tibet. Accumulating evidence shows a growing appreciation of the value of dental health by the Chinese people, with an increasing demand for the better type of dental service.

The medical profession in China is gradually becoming interested in dentistry. The Public Health Administrator Training School requires courses in oral hygiene, and the medical students of the three schools at Chengtu are required to take a dental course of one hour a week for one year. During the spring of 1940, the Szechwan Provincial Government published an oral hygiene reference book for public school hygiene teachers.

The Wenkiang Health Demonstration is a striking expression of the close cooperation between medicine and dentistry. The Demonstration Health Center, located in a small agricultural city, was established in 1940 for the purpose of affording practical teaching experience in public health for medical and dental students of the three universities at Chengtu. The program received financial support from the Rockefeller Foundation and the Chinese government. This is the first time that Chinese dental students have had access to this type of facility. Its main purposes are to make the students understand the prevailing rural social organization, and to provide a practical outlet for the application of the principles of public health that they have received in their school training. Furthermore, it affords an excellent opportunity to make closer the ties of understanding and cooperation between medicine and dentistry. The activities include preventive clinical work, out-call social service, maternal and infant health service, school hygiene and adult education, administration and general management.

PRESENT PROBLEMS AND FUTURE OUTLOOK

The most pressing problem facing dentistry in China is the lack of well-trained personnel to fill the need for dental teachers, practitioners, administrators, research workers and translators of dental lectures and journals. In most sections of the United States, it has been recognized that for each thousand of the population, there should be at least one dentist. An easy mathematical calculation shows that, on this basis, China will need 450,000 dentists. At present, there are only 300 qualified practitioners. It has been estimated that 2,500 dentists must be graduated annually in the United States to maintain the present dentist-to-patient ratio. Since the population of China is at least three times that of the U.S.A., it is evident that if China were to attempt to duplicate the type of service now available in America, at least 7,500 students would have to be graduated annually. Obviously, there must be a special plan for China, especially since it is a country of great size and with a large portion of the population living at a low economic level.

Ashley W. Lindsay, dean of the College of Medicine and Dentistry of West China Union University, R. Gordon Agnew, professor at the same institution, and others vitally interested in China's welfare are firmly convinced that public health dentistry, with group practice, is the logical solution of the country's great dental problem.

An idea of the national oral health legislation proposed for China may be obtained from a consideration of these points:

1. Dentistry in China must be associated with medicine, nursing and pharmacy in one public health service.

2. A national health bill for China must consider and put into effect a program of dental education, looking toward provision for a complete dental personnel to operate all phases of dental practice. Chinese dentistry will be practiced by two grades of practitioners. Professionally trained personnel will provide oral medical and surgical care, but purely technical requirements, such as restora-

tion of teeth, sanitation of the mouth and nursing assistance, must be supplied by those possessing only the technical background.

3. Although medicine, dentistry, nursing and pharmacy should coordinate their activities in one public health service, each must have its own internal organization so that essential differences can be arbitrated.

4. A public health dental program for China should be planned to provide: (a) community and provincial dental councils and a national dental council under the National Health Administration, which would make rules and regulations preliminary to approval of any plans submitted to the council, and administer the national phases of oral health; (b) preventive dentistry for children of all ages, chiefly to effect a reduction in the incidence of dental caries; (c) a comprehensive program of dental research, including study in both the biologic and the physical phases of problems related to dental science and art; (d) a comprehensive program of public health education including courses in oral hygiene for children, parents, teachers, nurses and the general public, and postgraduate instruction for medical and dental practitioners, and (e) public oral health clinics in small cities and towns to be served by traveling dental units. Under this set-up, the people of outlying villages would have the advantages offered by public oral health officers with a knowledge of preventive dentistry. A local authority charged with the duty of dispensing relief for the dentally indigent would decide who was eligible for dental care.

Financial support to establish national and provincial dental councils and to assure efficient operation of communal dental councils would be supplied by the national and provincial governments. The allocation of funds would be determined by (a) the population of the province; (b) the number of indigent persons for whom dental care is necessary; (c) the special dental problems of the province; (d) the financial resources of the province, and (e) the amount already being expended for public health by the province or the communities.

It is fortunate for China that there are as yet few vested interests to be considered in organizing either dental education or practice. Therefore, it should be possible, without fear or favor, to elaborate a program to meet existing conditions. It should also be possible to avoid the faults and failures of dental legislation and organization in other countries, and, at the same time, to fit dentistry into its proper place in the health welfare program of China's new social order after the war.

NUMBER AND DISTRIBUTION OF MUCOUS GLANDS OF THE HARD PALATE

(A PRELIMINARY REPORT)

By Carl August Schlack,* D.D.S., and Winder J. Edwards,† D.D.S.,
Bethesda, Md.

INTRODUCTION

EXTENSIVE gross and microscopic anatomic studies have been made and many articles and textbooks have been written concerning the tissues bounding the oral cavity. The mucous glands of these tissues have been described completely in regard to their histologic characteristics, but a thorough search of references here available revealed no written material pertaining to the numerical distribution of these glands in any part of the mouth.

PURPOSE

The purpose of this work is to determine the number of secreting glands from a selected area of oral mucous membranes.

PROCEDURE

When this study was undertaken, it was realized that a complete inspection of these glands as to number and distribution throughout all the oral tissues would require a great deal of time and apparatus. A complicated standardization would also have been necessitated. Consequently, the study was confined to the area of the hard palate adjacent to the first molar tooth.

Apparatus.—This consisted of

1. Cotton rolls.
2. Strips of paper 6 mm. in width the borders of which were outlined with an indelible pencil.
3. Cotton pliers.
4. A small throat light.
5. A magnifying glass.

Method.—1. The half of the palate to be examined was dried by means of cotton rolls.

2. A strip of the 6 mm. paper of a length corresponding to the distance from the median line to the gingivolingual margin of the first molar tooth was selected. The paper was marked into three equal segments with an indelible pencil.

3. The paper was next placed on the specified area and was maintained in position till the marks were transferred to the tissues, after which it was removed.

4. The patient was instructed to keep the tongue away from the marked region and to hold the mouth open in order to maintain a dry field for study.

5. After a lapse of two minutes, the small mucous droplets (secretion of the glands) in each of the three rectangular areas were counted with the aid of the throat light and a magnifying glass. It was noted that, after a lapse of three minutes or more, some of the globules would coalesce. Consequently, the two-minute interval was chosen to insure an accurate count.

From the U. S. Naval Dental School.
*Lieutenant Commander (DC) U.S.N.
†Lieutenant (DC) U.S.N.

EXPERIMENTAL DATA

Case No.	Median Third	Middle Third	Lateral Third	Total
1	10	11	2	23
2	7	9	6	22
3	10	7	1	18
4	8	8	1	17
5	8	5	2	15
6	7	7	1	15
7	7	5	3	15
8	6	8	1	15
9	5	8	2	15
10	4	8	3	15
11	9	5	0	14
12	5	8	1	14
13	8	5	0	13
14	6	5	1	12
15	6	6	0	12
16	7	5	0	12
17	7	5	0	12
18	8	3	0	11
19	7	4	0	11
20	6	5	0	11
21	5	6	0	11
22	5	6	0	11
23	5	4	2	11
24	4	6	1	11
25	4	6	1	11
26	6	4	0	10
27	4	5	1	10
28	4	6	0	10
29	4	6	0	10
30	3	5	2	10
31	4	5	0	9
32	4	5	0	9
33	4	5	0	9
34	3	5	0	8
35	3	5	0	8
36	3	5	0	8
37	2	5	1	8
38	3	4	0	7
39	3	3	1	7
40	2	5	0	7
41	2	3	2	7
42	2	3	1	6
Average	5.2	5.6	0.85	11.7

Forty-two male patients between the ages of 19 and 36 were thus examined.

RESULTS

The average number of glands in the areas examined was 11.7. The average number of glands in the mesial third was found to be 5.2; in the middle third, 5.6, and in the lateral third, 0.85. The greatest number in the entire area in any one patient was twenty-three and the smallest number six. An interesting observation was that few glands were close to the median line or close to the tooth itself. In most cases, they were clustered about the junction of the median and middle thirds.

The results are illustrated by the accompanying table.

CONCLUSIONS

With the relatively small number of subjects examined, no definite conclusions could be drawn. To convey the idea that similar results are to be expected in other areas of the palate is not intended. Nor should the conclusions be drawn that similar results would be obtained in female patients or in other age groups. Rather, this report is to be considered preliminary for this age group of males and definite conclusions will require further study.

The opinions or assertions contained in this article are the private opinions or assertions of the writer and are not to be construed as official or reflecting the views of the Navy Department or the Naval service at large.—Article 113, U. S. Navy Regulations.

TREATMENT OF DISEASE OF THE MAXILLARY ANTRA OF DENTAL ORIGIN

By George W. Christiansen,* A.B., D.D.S., M.S., Detroit, Mich.

DISEASE of the maxillary sinuses, which is well known as a clinical entity, embodies varying degrees of disability, ranging from mild hypersusceptibility to exposure to almost complete impairment of health.

The causes may be divided roughly into two groups: first, nasal, including the so-called head colds of coryza and rhinitis, and obstruction of the nares from malformation, injury, hypertrophy or vasomotor rhinitis, and, second, oral conditions whereby secretions containing saprophytic and other mouth organisms are introduced into the sinus through the floor or walls.

Regardless of the beginning, the generalized effects of the disease are far reaching and manifest themselves in a number of crippling ways, chief of which are bronchial infections,[1] although such conditions as arthritis and neuritis are frequently attributed to the same source. When thickened through degeneration, the membranous lining of the maxillary sinus becomes a potential pathogenic bacterial focus, and transmission of its organisms may begin. Salinger[2] mentions the fact that Semenov,[3] in his excellent work on the surgical pathology of the sinuses, has shown that "thickening in excess of 2 mm. is associated with deep seated degenerative changes in 50 per cent of the cases." Salinger says further:

In addition, cultures from aspirated irrigating fluid yield bacteria that are particularly pathogenic when injected into experimental animals. One may feel even more certain that the sinus is the seat of a chronic infection which is more than likely the focus sought . . . That infection may be transmitted via the lymphatics and the venous system from the antrum to the lower air passages as well as by direct aspiration, has been proved experimentally by Mullin and Ryder[4] and others . . . that in many cases chronic bronchitis, bronchiectasis or asthma, which defied other therapeutic measures, has cleared up or been largely ameliorated after radical operation on the sinuses, has been attested by many workers.

Grove[5] quotes Kistner as saying:

Although hyperplastic sinuses are not suppurating, they are usually infected with pathogenic organisms, the streptococcus predominating. A mixture of bacteria was usually found in each case. A pure culture of one organism was seldom found in cases of chronic sinusitis. In these tissues the streptococci were the most constant, being present in 94.5 per cent of the sinuses; 35 per cent of these were hemolytic . . . The high percentage of the hemolytic streptococcus in the antral membranes indicates its importance as an agent of infection which often may be overlooked. This is well illustrated in one patient who had eight cultures of the antral washings over a period of five years and showed only pneumonia and *Streptococcus viridans*, with an occasional staphylococcus. A culture of the left antrum membrane after operation yielded a pure growth of hemolytic streptococcus . . . A clear return flow from the antral irrigations may be sterile, but a heavy growth of one or more organisms may be cultured from membranes removed at operation . . . Clinical observations as well as bacterial studies led to the conclusion that chronic hyperplastic sinusitis is caused by bacterial infection and represents a special type of bacterial

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*Lt. Comdr., D.C., U.S.N.R., Navy Pier, Chicago, Ill.

allergy . . . Hemolytic streptococci are found twice as often in the antral membranes as they are in the washings, or in the ethmoidal and sphenoidal membranes.

The antrum may be contaminated from the mouth by the presence of diseased root ends of upper bicuspids and molars, or retained unerupted cuspid, bicuspid or molar teeth, and by extraction accidents whereby the floor or lateral wall is perforated. Obviously, our interest from the treatment standpoint is limited to this type of case.

Hempstead,[6] in reviewing the results of treatment of 385 cases of chronic maxillary sinusitis, discovered that

> . . . many were able to trace the infection in the antrum to a diseased tooth or to its extraction. In 22.5 per cent of the cases, the infection clearly followed extraction of abscessed molars. In sixty-three cases, a fistula extended through the alveolar process and into the antrum.

The foregoing statements indicate that mouth infection is an important contributing factor in chronic maxillary sinusitis and, further, that this disease may incapacitate one. Therefore, before we enlarge a root socket or make a lateral window in search of a root, or attempt to close an antral-oral fistula, sufficient investigation should be made to acquaint ourselves thoroughly with the situation within the antrum.

The most common problem is that of accidental puncture during extraction and passage of a root fragment into the antrum. Consternation reigns when this occurs and, in the absence of careful planning, a search is often attempted through the socket, and when this is unsuccessful, the socket is enlarged, usually with a bur. If a large opening is not made, the root seldom is recovered, and if the aperture is enlarged sufficiently to permit a successful quest, probably a persisting perforation will remain, so obviously this approach is unsound fundamentally. When it is employed, the healing effort fails because the bone

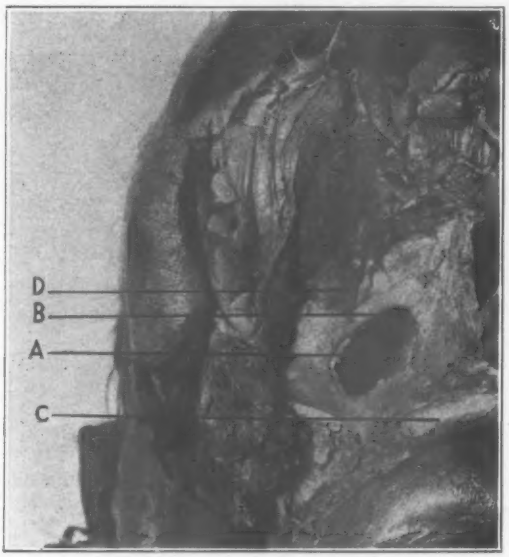

Fig. 1.—A, Caldwell-Luc window and transantral view of nasal wall. B, approximate location of ostium maxillare. C, edentulous superior maxillary ridge. D, infra-orbital nerve and artery.

borders have been traumatized and the clot sloughs; secretions utilize this outlet because of its dependency, and unhealthy granulation tissue fills it. To close such an opening may require the skilful use of a large palatal flap and the creation of a nasal window as well.

The simple, practical direct point of entry into the maxillary sinus, whether for regaining a root tip or for inspection and curettage, is through a window above the roots of the bicuspids and first molar teeth (Fig. 1), but not before careful examination to determine what the condition of the antral contents is. Therefore, before beginning any work on the antrum, the following studies should be made:

1. An anteroposterior roentgenogram of the maxillary and frontal sinuses.
2. Transillumination.
3. Digital examination to elicit any tenderness over the anterolateral wall of the antrum.
4. Inquiry as to a possible history of bronchitis or bronchiectasis.

The knowledge gained from this investigation is of great value in planning treatment. If the results show no abnormality, one need not hesitate in the search for the root; but if the membrane is chronically diseased, provision must be made to correct this when the antrum is open, and the patient should be enlightened as to the findings. Coexisting disease of the adjacent air spaces will delay or prevent normal healing of the antrum, and one must be aware of such a handicap.

TREATMENT OF ACUTE SINUSITIS

Accidental opening of the antrum sometimes is followed by severe inflammation of the lining which results in a foul and copious discharge. Because of its position and size, high in the nasal wall (Fig. 2) the *ostium maxillare* is usually incapable of providing enough of an outlet, and an intra-antral pressure that can become very distressing develops. Symptoms of this pressure are tenderness over the lateral wall of the antrum, postnasal putrid dripping and soreness of the orbital floor and in the upper bicuspid and molar teeth. Sometimes, a small flexible cannula can be introduced for lavage through the oral opening which, with the aid of the natural ostium, provides sufficient vent. But when this cannot be done easily and

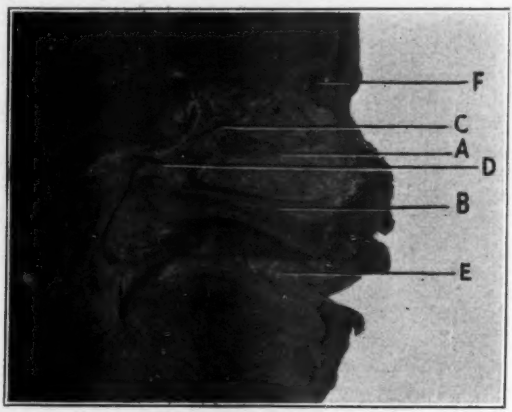

Fig. 2.—Sagittal section of wet specimen. A, ostium maxillare in middle meatus. B, inferior meatus. C, superior meatus. D, eustachian tube (pharyngeal opening). E, oral cavity. F, frontal sinus.

rapid emptying be obtained, a nasal window is needed under the anterior portion of the inferior turbinate. (Figs. 3, 4 and 5.) Construction of this window is simple after the application of a topical anesthetic to the inferior meatus wall. Usually, an acute attack clears up in a few days with free drainage and ventilation, but if symptoms persist, a hyperplastic perforation, roentgenographic examination usually reveals cloudiness of the antral shadow, indicating hypertrophy of the membrane. Flap closure is seldom successful if the lining mucosa is abnormal. In fact, the persistence of the fistula is evidence that the sinus is ailing and requires inspection and treatment.

The Caldwell-Luc window affords an

Fig. 3.—Sagittal section of wet specimen. A, probe in ostium maxillare. B, probe in nasal drainage window under inferior turbinate. C, middle turbinate reflected backward to show ostium. A lower level of drainage is obtained at B, as compared with that afforded by the natural opening (A).

change in the lining mucosa should be suspected.

TREATMENT OF CHRONIC SINUSITIS WITH ORAL FISTULA

If a fistula persists long after antral excellent view (Fig. 6) of the antral contents. It is not mutilating or disabling, and when the tissues are treated kindly, little postoperative edema results and the flap reattaches itself readily. Prolonged retraction during operation is inadvisable

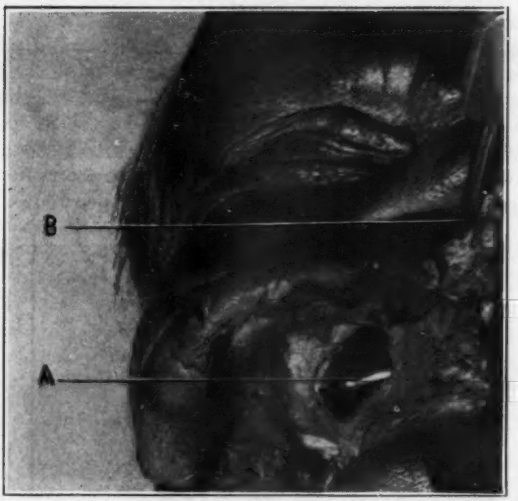

Fig. 4.—Anterior view of wet specimen with upper lip elevated. A, end of cannula in antrum viewed through Caldwell-Luc window. B, cannula in right naris.

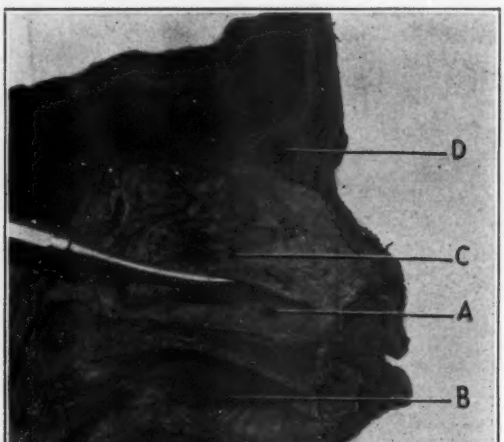

Fig. 5.—Sagittal section of wet specimen. A, location of nasal drainage window with inferior turbinate elevated. B, oral cavity. C, ostium maxillare, about 3 cm. higher than drainage window. D, frontal sinus.

and reflected structures need relaxing often to return to normal position, in order to reduce undesirable postoperative sequelae. Since the posterior, middle and anterior-superior alveolar nerves pass through the corresponding surfaces of the antrum and the nasopalatine and anterior palatine nerves travel downward to the palate along the medial wall of the cavity, blocking them and applying a topical anesthetic to the middle and inferior meatuses produces adequate anesthesia. (Fig. 7.)

Examination of the antral contents, of course, determines the conduct and extent of treatment. Several conditions may exist: Only the lining around the fistula may be diseased or a large part or all of it may need enucleation. A thickened hyperplastic membrane frequently has little or no attachment and is easily peeled off the bone. Persisting sensitiveness of the membrane is controlled by laying half inch plain gauze moistened with a topical anesthetic against the tender areas.

During operation, the most common source of hemorrhage is the posterior superior alveolar branch of the pterygopalatine section of the internal maxillary artery in the posterior wall. (Fig. 7.) Trauma from manipulating unerupted third molars can rupture this vessel also, and pressure or crushing of the overlying bone is required for hemostasis.

Before closing the antrum to the mouth, an inferior meatus outlet is made, and through this all further treatment of aspiration or lavage is given.

SUMMARY

Maxillary non-vital bicuspids and molars and unerupted maxillary teeth may, by bone absorption, penetrate the antrum, and extraction of teeth the roots of which approximate the sinus floor can also open the maxillary sinuses from the mouth. Degeneration of the lining mucosa may have a dental source as readily as any other and treatment requires the same drainage, ventilation and removal of the diseased lining. A hasty, poorly planned surgical operation on the antrum bears bitter fruit, and the following admonitions may aid in avoiding trouble:

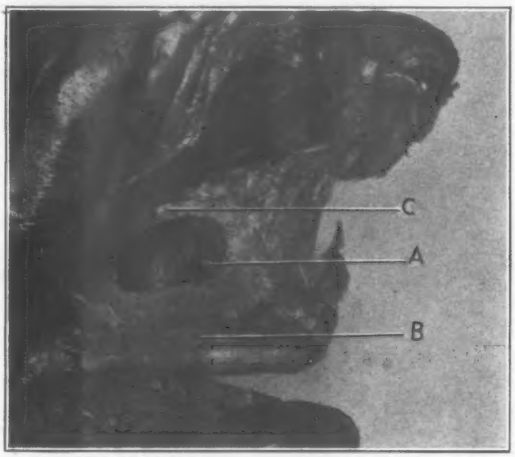

Fig. 6.—Lateral view of wet specimen. A, transantral view of drainage window. B, approximate level of antral perforation from extraction accidents. C, approximate level of ostium maxillare.

1. Determine, by using all available aids, the health status of the antral lining as to hypertrophic degeneration and polyposis, before opening into the antrum.

2. Do not enlarge a socket for root removal from the antrum in any case, particularly when the sinus is diseased.

3. Do not leave gauze or cotton plugs in an antral-oral opening after accidental puncture; Let such openings close without interference, as quickly as possible.

4. Investigate when facial pain follows extraction of teeth the roots of which approximated the sinus floor. The distress may be due to the pressure (pain) of an acute sinusitis.

5. Do not attempt to close a mildly discharging persisting fistula without ruling out sinus disease, and remember that a low nasal window for ventilation of the antrum is a great aid in closing these abnormal outlets.

6. Remember that since nasal and antral secretions will empty by the lowest outlet, when a mouth opening is made in the alveolar ridge healing will have the added complication of those secretions.

7. Do not attempt to control severe persisting antral hemorrhage following the extraction of an upper posterior tooth, by packing gauze in the communicating socket. Open the antrum to expose the source of bleeding and stop it there.

8. Do not be too disturbed if a root is pushed into the antrum. If the sinus is healthy, a properly made window will permit easy recovery. If it is not healthy, the contents should be exposed, at which time the root will be found.

Fig. 7.—A, sphenopalatine nerves. B, sphenopalatine ganglion. C, posterior wall of antrum where posterior-superior alveolar artery passes. D, lateral wall of antrum removed to show nerve supply of molar and bicuspid teeth.

9. Hesitate to advise retention of questionable teeth which may injure the sinus floor. This applies equally to unerupted teeth and teeth in normal position.

10. Do not introduce any purported healing or germicidal paste into the antrum in the treatment of antral-oral fistula.

11. Finally, when there is roentgenographic evidence of an unusually low antral floor, use extra precautions in

extracting the adjacent teeth, and remember that mouth openings are difficult to close in the presence of sinus disease, whether of bacterial or of allergic origin.

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ROOT RECOVERY FROM THE MAXILLARY SINUS

By WILLIAM E. DURBECK, D.D.S., San Antonio, Texas

DISPLACEMENT of the upper root tip into the maxillary sinus constitutes one of the most distressing accidents in the extraction of teeth. The situation is made more embarrassing by the usual lack of confidence of the general practitioner in his ability to cope with the problem. The root is either clumsily removed or allowed to remain, the condition, in either case, inviting sinus disease, which demands surgical management by more competent hands. An effort will be made to present a simplified surgical approach that will lend itself to general use by the dental practitioner.

Surgical invasion of the sinus for a strictly dental purpose cannot be criticized on any score provided the operator is competent, although there is no implication that the average dentist is qualified to treat routine sinus disease. For this reason, no mention of antral pathosis will be made. Assuming that the sinus is not diseased, the prognosis following root recovery is favorable. Indeed, should the operator, upon opening the sinus, find evidence of preexisting disorder, he may be assured that an entry, if skilfully done, will do nothing to aggravate the condition. Antral entrance in dentistry should be made only for the specific purpose in mind and executed with all dispatch consistent with good surgical procedure.

It seems contrary to good surgical judgment to attempt delivery of the displaced root tip through the socket. This route, limited in accessibility and offering little or no view of the sinus cavity, presents the added handicap of being difficult to close surgically. If the accidental opening into the cavity has been enlarged for the convenience of the operator, adequate closure is well-nigh impossible. Rather, it is wiser to promptly occlude the orifice of the socket with any acceptable surgical dressing, allowing granulation to begin the healing process unhampered by surgical trauma and protected from oral fluids. Recovery of the root fragment is immediately accomplished by a route presenting fewer surgical obstacles and postoperative complications.

The Caldwell-Luc approach through the thin bone found just above the bicuspid roots offers the surgeon the way of greatest dispatch, accessibility and uneventful recovery, combined with adaptability for use at the dental chair. With minor variations, recovery of the root fragment becomes a comparatively simple procedure, uncomplicated by blind probing and other traumatic manipulation which contributes to undesirable postoperative sequelae.

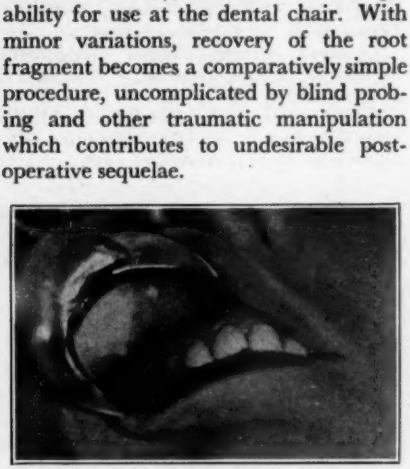

Fig. 1.—Usual Caldwell-Luc incision.

Fig. 2.—Case in which incision has been made from lateral incisor to mucobuccal fold. After the interdental septa have been severed, an excellent view is afforded on retraction of the flap.

A discussion of the surgical anatomy of the maxillary sinus is necessary before operative details are considered.

The maxillary sinus, the largest of the accessory nasal sinuses, lies within the body of the maxilla and is roughly pyramidal. Its base may be considered the lateral nasal wall, from which the sinus extends to its apex in the zygomatic process. Through its roof, which separates it from the contents of the orbit, passes the infra-orbital canal. The floor of the sinus is formed by the alveolar process and is characterized by conical elevations corresponding to the roots of the posterior teeth. No consistency is displayed in the incidence of these elevations, which may range from those of the first and second molars alone to the entire complement from the third molar

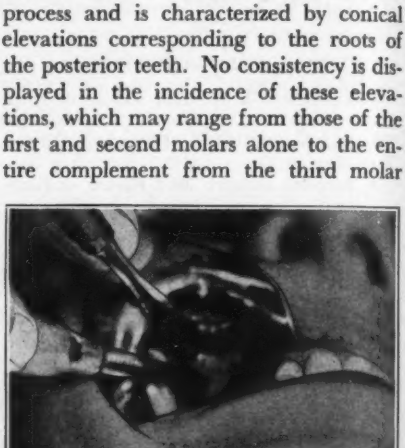

Fig. 3.—Point of Crane pick inserted through thin bony plate preparatory to breaking away portion of structure.

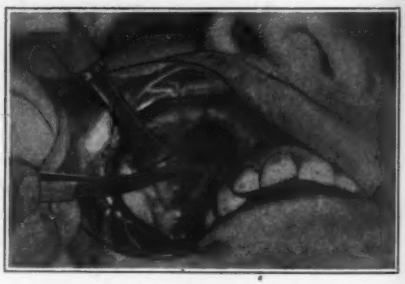

Fig. 4.—Removal of root with cotton pliers that have been straightened; after antral opening has been enlarged by use of rongeurs.

to, and sometimes including, the cuspid, in excessively large sinuses. The floor of the structure is usually ridged transversely by one or more poorly developed septa.

It is of surgical importance that the floor of the cavity is usually on a level with the floor of the nose, but is not infrequently found at various depths up to 10 mm. beneath the nasal floor. The lateral nasal wall, or base of the sinus, is formed

not only by the maxilla, but also by the uncinate process of the ethmoid from above, the ethmoidal process of the inferior nasal turbinate from below, the vertical part of the palatine from behind and a small portion of the lacrimal area from above and in front. Through the incomplete closure of these bones are two small openings, one usually closed over by mucous membrane; the other, near the upper and forward part of the cavity, patent and opening into the middle meatus of the nose. It is through this ostium that ventilation of the sinus is effected.

Massive inflammation of the mucosal lining of the sinus frequently closes the ostium, thus adding lack of aeration to the existing disease process and precluding drainage of its resultant fluids. For this reason, in medical practice, surgical invasion of the badly diseased maxillary sinus via the Caldwell-Luc approach is frequently accompanied by resection of the base of the sinus at the level of the inferior nasal meatus in order that adequate drainage and ventilation may be maintained during convalescence. This procedure is never indicated following the prompt delivery of a root from a previously healthy sinus.

Fig. 5.—Case after gingival flap has been returned to original position. Even lateral traction on the retractor does not disturb the approximation.

This site for resection of the base is selected, first, because of its mechanical advantages for drainage of the sinus by gravity and, secondly, because, in this area, density of the bony wall is minimal. Its eggshell-like thickness is duplicated in the bone found just above the root end of the second bicuspid, which, in addition to its accessibility, designates it as the area of choice for the surgical opening of the underlying sinus cavity.

Inflammation of the mucosa lining of the maxillary sinus is basically the same as any other mucous membrane. It is sufficient to mention that the ciliated epithelium becomes disorganized at a greater rate than would be elicited by the same irritant in a less sheltered and protected location. Cellular infiltration is usually of a greater degree, as are the macroscopic swelling and thickening of the structure. The incidence of fatty and mucoid degeneration is relatively higher than would be found in mucosal epithelium having a more active physiologic rôle. For this reason, clinically a chronically diseased maxillary sinus is characterized by marked polypoid changes.

If the operation is to be performed under general anesthesia, facilities must be available for pharyngeal catheterization, since a face or nasal mask precludes retraction of the upper lip, which must be had for sufficient access to the field. Should local anesthesia be chosen, infiltration above the bicuspid roots is usually sufficient, since anesthesia of the entire sinus membrane is unnecessary.

The Caldwell-Luc operation classically begins with a semilunar incision in the bicuspid region carried through to bone with its concavity directed upward. (Fig. 1.) The involved tissue is then elevated and reflected upward for vision of the operative field. It is rather obvious that an incision of this type offers only a meager bony shelf on which the flap may rest after approximation of the incision. With this disadvantage, it must be considered that the location of the incision subjects it to traction with every movement of the adjoining facial muscles.

Since a large flap will heal as rapidly and as painlessly as a small one, the disadvantages of the original Caldwell-Luc incision may be offset by inserting the scalpel at the gingival margin in the region of the lateral incisor and carrying it boldly up into the mucolabial fold. Interdental gingival septa are now incised on the buccal aspect posteriorly to and including the septum between the first and second molar. The flap is now elevated and retracted in the usual manner, with exposure of the field. (Fig. 2.) A casual observation will reveal the fact that all incisions are sufficiently distant from the site of the subsequent antral opening to insure perfect closure upon replacement of the flap. This fact precludes invasion of the sinus cavity by oral fluids and, in addition, offers maximum protection from displacement of the flap by the normal functioning of those muscles supplied by the seventh cranial nerve.

The area of minimal bony thickness is now located approximately a quarter inch above the tip of the second bicuspid. Slight pressure on a Crane pick is sufficient to force entrance, while leverage on the instrument will readily sever an adequate amount of the thin bony plate for subsequent manipulation. (Fig. 3.) A small beaked rongeur is now used, with due regard to the proximity of the bicuspid roots, to cut away a sufficient quantity of the surrounding bone and provide an adequate view into the sinus. During the entire procedure, a suction tip is used to prevent hemorrhage of the external soft tissue from invading the sinus. Under no cricumstances should the surgical bur or chisel be used to gain entry, since small bits of bony débris reaching the sinus membrane are not only difficult to remove, but also are certain to cause postoperative inflammation of the structure, if allowed to remain.

Because of the easy access provided by the preceding technic, recovery of the root tip is simple. Under no circumstances should its delivery be effected by flushing the cavity with an irrigating solution, since this procedure removes the protective serum of the membrane. A more satisfactory measure is to grasp the tip with a pair of cotton pliers the beaks of which have been straightened to make the instrument a more efficient one for this endeavor. (Fig. 4.)

If the operator has worked with efficiency, no external blood or débris will have found its way into the cavity. Any small blood clots from the original accidental opening are allowed to remain for later resorption. No dressing is inserted, but the flap is returned with dispatch, thus effectively sealing the sinus against all external influences. (Fig. 5.) Sutures may be removed after the first forty-eight hours of convalescence.

SUMMARY

1. It is within the province of the dentist to remove root tips displaced into the maxillary sinus.

2. Surgical judgment dictates that the removal not be effected through the alveolar socket.

3. A large buccal flap is preferable to the original Caldwell-Luc incision.

4. It is wiser for the dentist to confine his activities to the delivery of the displaced root. Discretion demands that preexisting antral pathosis be surgically ignored and referred to a competent otolaryngologist.

Medical Arts Building.

PAGET'S DISEASE: REPORT OF A CASE

By ALLEN T. NEWMAN,* D.D.S., and MILTON HYMAN,† D.D.S., New York, N. Y.

PAGET's disease, or *osteitis deformans*, is of unknown etiology. It is characterized by an initial bone resorption, which is followed by bone deposition. The deposited bone is thick and porous, involving both the cortex and spongiosa, with a consequent increase in bone volume. The entire process is a slow one.

The bones most commonly affected are the tibia, skull, pelvis and femur.[1] These become thickened and deformed, and the limbs bowed. The skull becomes enlarged and square across the front. Cyst formation may occur in the legs. The patients often complain that they must buy new hats, since their old ones are too small. The disease is most common in middle life or later.[1, 2] That the condition has been considered relatively rare, Stafne and Austin[3] attribute to the fact that only the more advanced forms have been recognized.

The roentgenographic picture of Paget's disease probably is dependent on the stage at which the disease is seen. Since this is a dental report, only the skull and jaws will be considered. *Osteoporosis circumscripta* is considered an early osteolytic phase affecting the skull. In the later stage, the skull has a typical "cotton-wool" appearance. In a study of 138 known cases of Paget's disease reported by Stafne and Austin, 58 per cent of skull pictures presented definite evidence of the disease. In only twenty-three cases did they find definite involvement of the maxillae and mandible, twenty in the maxillae and three in the mandible. This seems to bear out other findings that the mandible is rarely affected.

The cases reported in dental literature show a wide variance in roentgenographic findings. Fox[4] found cystic involvement of the apices of the maxillary teeth, hypercementosis of the roots and a feathery spongious appearance of the maxillary bone. Seldin[5] described a bilateral involvement of the mandible, with alternate areas of resorption and calcification, and hypercementosis, evident in the roentgenogram. Cahn[6] reported a characteristic hazy structure of the bone due to an increase in the number of trabeculae. Islands of hypercalcification were also noted.

Stafne and Austin were fortunate in being able to follow up cases of Paget's disease. As a result of their study, they stated that the roentgenographic appearance probably depends on the stage at which the disease is seen. In the early stages, the dominant feature is probably osteoporosis, while, in the advanced stages, the presence of osteosclerotic areas may result in an uneven mottled appearance. In 17 per cent of their cases, they found fine, close trabeculations, which invariably occurred in those patients showing Paget's disease of the skull. However, they considered these variations to be within normal limits.

REPORT OF CASE

History.—F. H., a man, white, aged 70, complained of pains, of three years' duration, in the right leg, arm, both knees and back and across the chest. During the past year, he had been having trouble with his hearing. He had been treated by physicians without relief. He wished to have his teeth

From the New York University College of Dentistry.
*Dean.
†Assistant Professor of diagnosis.

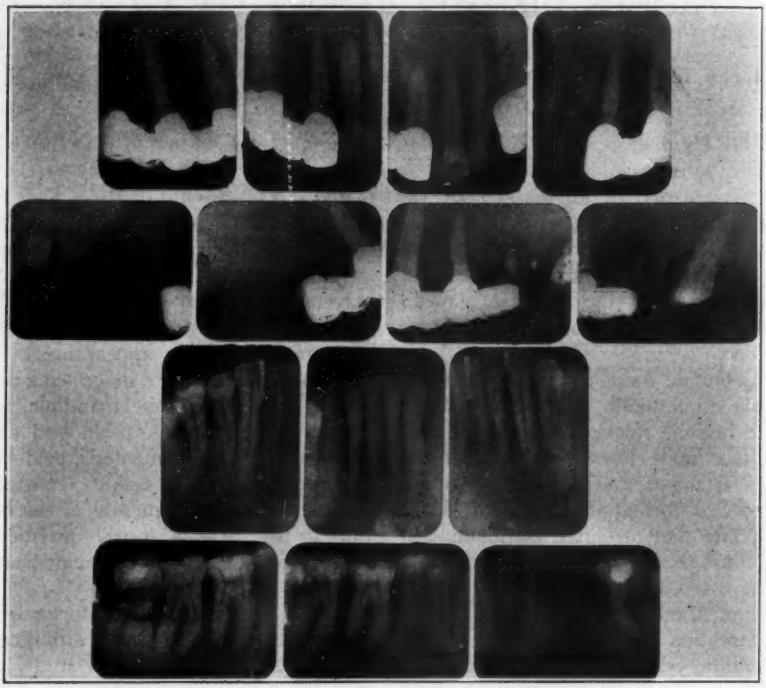

Fig. 1.—Paget's disease involving the maxillae; showing osteoporosis of anterior region and radiopaque appearance of remainder of alveolar bone. The mandibular bone is normal.

Fig. 2.—Skull showing characteristic "cotton-wool" or "cotton-puff" appearance. The bones of the calvarium are thickened, with very fuzzy inner and outer tables.

examined to determine whether they might be a focus of infection.

Physical Examination. — The patient weighed 156 pounds and was 5 feet 7 inches tall. There was nothing of special importance in the mouth. The occlusion was within normal limits, but the maxillary ridges were very heavy, ranging from 1 to 1½ inches in width.

Roentgenographic Findings.—1. Maxillary region: The maxillae showed marked alteration. (Fig. 1.) Osteoporosis was noted in the region from the upper left central incisor to the cuspid, and the right central incisor to the second bicuspid regions. The remainder of the bone seemed to have lost its normal trabeculation. It was radiopaque, granular and hazy in appearance, the trabeculae being finer and more closely woven. No hypercementosis of the roots was observed.

Fig. 3.—Right femur with cyst formation, most common in leg bones.

2. Mandible: The mandible was normal.

3. Skull: There was a typical "cotton-wool" appearance of Paget's disease. (Fig. 2.)

4. Right femur: Cyst formation was evident. (Fig. 3.)

Fig. 4.—Osteoporosis between central incisors and central and lateral incisors. (Compare Fig. 5.)

Fig. 5.—Normal anterior radiolucency, most marked between central incisors and right central and lateral incisors in patient aged 47.

Medical Report.—On the first visit, May 31, 1940, the patient complained of burning pain of the right thigh. A roentgenogram suggested central chondroma or chondro-

sarcoma. Aspiration biopsy disclosed an inflammatory lesion, possibly xanthomatosis. The patient was given small doses of the x-rays in this area. October 1940, there was no change in right femur, but the left femur presented the appearance of Paget's disease. The roentgenologist stated that the x-ray appearance of the right thigh might be due to a healed cystic condition, and that both lesions were probably due to Paget's disease.

COMMENT

Stafne and Austin attach much importance, from a diagnostic viewpoint, to the osteoporosis found in the maxillary bone. (Fig. 4.) However, these authors wish to stress the inadvisability of placing too much emphasis on this point alone. While the osteoporosis may be marked, a similar radiolucent appearance can often be noted in otherwise normal cases. (Fig. 5.) This normal radiolucence may be due to the thinness of the alveolar plate at that point, or it may be an optical illusion created by the contrast between the radiopaque, roentgenographic appearance of the tooth as compared with that of the adjacent bone.

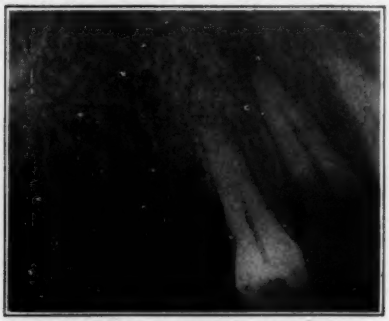

Fig. 6.—Normal bone trabeculations in maxilla; showing size, shape and number of trabeculae as compared with those in Figure 7. Since the patient was 64 years of age, any variation due to age can be ruled out.

However, the bone trabeculation of the maxillae does possess diagnostic value, as demonstrated by this case. Greenfield[7] describes the normal cancellous bone as made up of fibrils of bone that interlace and form a lattice-like or trabeculate structure. Roentgenographically, one finds a white network enclosing irregular black spaces. In the upper jaw, the black spaces appear smaller and more regular than in the lower. The white network is thinner. (Fig. 6.)

Examination of the roentgenograms in the case here reported shows that the black spaces between the white trabeculae appear very small and fine, and a great many trabeculae crowd the space normally occupied by a single trabecula. (Fig. 7.) This increase in number of the trabeculae has also been reported on microscopic examination. This fine trabeculation can even be seen in the osteoporotic regions of Figure 4, while the normal trabeculation shows quite clearly in the area of anterior radiolucency in Figure 5.

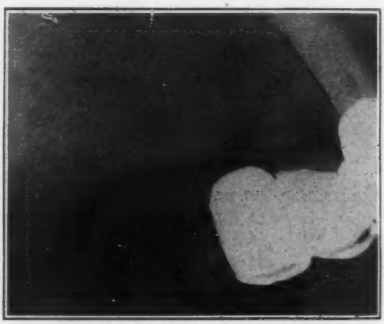

Fig. 7.—Paget's bone trabeculations.

The hypercementosis reported by other investigators is not in evidence in this case, and may not be a constant factor.

SUMMARY AND CONCLUSION

In a man aged 70, roentgenograms disclosed Paget's disease involving the skull, femur and maxillae. The skull showed the typical "cotton-wool" appearance, the femur, cyst formation. Two separate phases were seen in the maxillae: osteoporosis and osteosclerosis. The os-

teoporosis might be confused with normal anterior radiolucency.

The bone deposition took the form of an increase in trabeculae, giving the bone a hazy appearance. The mandibular bone was normal. No hypercementosis was present.

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FACTORS OF OCCLUSION IN RELATION TO MOUTH REHABILITATION

By HARRY M. SEIDES, D.D.S., New York, N. Y.

MOUTH rehabilitation implies that impairment of the elements which contribute to the maintenance of masticatory efficiency has taken place. In some instances, this may result in loss of the normal maxillomandibular vertical dimension, often modifying facial contour. Since masticatory efficiency depends on a thoroughly equilibrated occlusion, the primary requisite for successful treatment of mouth rehabilitation is an understanding of the factors in normal occlusion and the method of correcting discrepancies.

The following is offered as a standardized procedure for the purpose of establishing a diagnosis and as a basis for treatment planning:

1. Clinical examination of the mouth.
2. Evaluation of habits as factors in occlusion.
3. Appraisal of occlusal discrepancies after mounting of casts on an adjustable articulator.

A clinical examination of the mouth is made and pathologic conditions of the teeth, supporting parodontium and contiguous structures are recorded. An intra-oral roentgenographic examination is made, and where temporomandibular involvement is suspected, the temporomandibular joints are also roentgenographed. When occlusal disturbances are evident, there is a breakdown in the occlusal mechanism with resultant impairment of function. Clinical examination of the occlusion should be given careful consideration and the degree of destruction of the dental tissues observed and recorded, including the status and function of the musculature of the jaws.

Sequelae of occlusal discrepancies that may manifest themselves clinically are attrition; drifting of the teeth, occasionally coupled with alveolar resorption, and disturbances in the temporomandibular capsule and its ligaments, or a combination of these conditions. These conditions may result from the loss of a tooth or part of a tooth with a subsequent deficiency which may also be manifested as a disharmony between condylar movement and tooth guiding inclines. (Fig. 1.)

Tooth replacements without regard for the established laws of occlusion are additional factors in occlusal deficiency, as are abnormal tooth eruption, anomalous growths and abnormal bone development. Occasionally, traumatic injury may also be responsible for disturbance of occlusal relations.

Although they may be easily overlooked in evaluating masticatory dysfunction, the habits and mannerisms of the patient may be considered as powerful factors in occlusal disharmony. The practice of harmful postural and occupational habits, and "night grinding," may be responsible for destructive reactions which may appear clinically as unilateral function, unilateral abrasion or a limit in range of masticatory excursion, caused by a drifting or loosening of the teeth. One of the reactions to occlusal dyscrasia is the habitual limitation of functional range from a voluntary attempt to avoid the discomfort induced by cusp interference. This often results in spasmodic muscular movements, which may be observed when the mouth is opened or closed.

Consideration of the foregoing phenomena requires an understanding of the action of the musculature controlling the movements of the jaws and the relation of the teeth, jaws and joints of the entity that we regard as the masticatory mechanism.[1] This is important, since a disturbed relationship of these muscles disrupts the normal elements of masticatory function and predisposes the mandible to disharmony, with painful and conflicting sequelae.

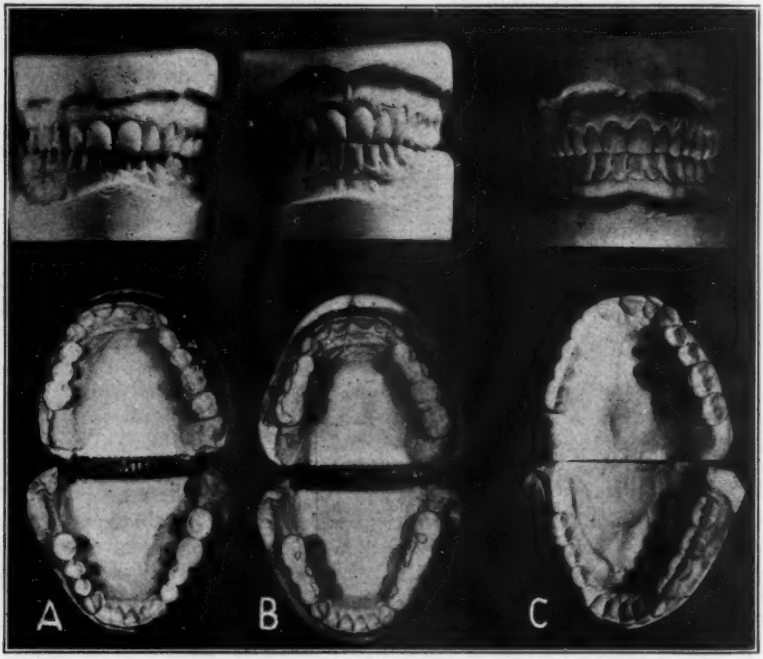

Fig. 1.—A, loss of vertical dimension through improper occlusal restoration, causing excessive anterior strain, as shown by spacing between central incisors. B, splints constructed to rebuild deficient occlusal structure and to relieve anterior strain, made according to build-up on study models. There is natural closure of the diastema between the central incisors. C, final restoration, replacing splints to maintain normal vertical dimension.

When the muscles responsible for the opening, closing and lateral excursive movements of the mandible reach a state of balanced or neutral tonicity, we can say that a position of physiologic rest has been achieved. This can be demonstrated by gritting the teeth firmly and then suddenly relaxing the muscles. It will now be found that the mandible instantly drops to a definite position of rest, which is modified slightly by the weight of the mandible.[2] This relaxed position of the mandible, referred to as "physiologic rest position," should be differentiated from the position of the mandible when the teeth are in actual maximum occlusal contact. When the teeth are in contact, muscle force is brought into play and a dynamic relationship is established, which is centric occlusion. The distance normally found between physiologic rest position and centric occlusion is known as the "free-way space."

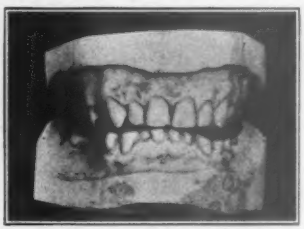

Fig. 2.—Use of wax biteblocks to determine vertical dimension where there are no posterior contacts for guidance.

When there is a loss in the maxillo-mandibular dimension of the teeth, there is an increase in the dimension of the free-way space. Contrarily, when there is an excessive opening in the maxillo-mandibular relation, the muscles of jaw closure are under excessive tension and strain. Since it is impossible for them to return to neutral rest position, a hazard is introduced that may manifest itself in muscle fatigue or trismus and other attendant pain or discomfort.[3] Failure to consider this vital fact may account for failures in mouth rehabilitation even when a case is constructed to a degree of opening that establishes incisal clearance.

A free-way space of about 3 mm. should be maintained. In increasing the vertical dimension, a new plane of orientation must be established somewhere between the position of physiologic rest and centric occlusion. The degree of change should not be so severe as to eliminate the free-way space.

The third procedure in diagnostic considerations is the employment of accurately made study casts, accurately mounted on an anatomic articulator. It is necessary to record centric relation in order to establish centric occlusion. The mounting of casts requires the establishment of the rotation point of the condyle and the articulation of the casts in centric relation, together with a recording of condylar path inclination.[4]

The articulated cases offer a visual aid in analyzing the discrepancies in occlusion and in planning their correction. These casts should be mounted in centric relation so that a composite reproduction of the mouth is obtained, from which the discrepancies in occlusion can be studied and corrective procedures can be planned.

Hight[5] says:

> Tooth relations should not be confused with jaw relations. Centric occlusion refers to the harmonious interrelation of opposing teeth. Central relation is a jaw position. . . . Therefore, centric relation indirectly becomes a tooth relation only after the teeth have been arranged in accordance with the recorded centric jaw relation. This statement implies that the two must be in harmony.

Since the primary consideration is to establish an equilibrated occlusion, the minimum alterations that must be made to accomplish this result are determined from careful examination of the study casts. Cusp points that interfere with harmonious function are trimmed down on the cast and deficient areas are restored in wax.

Because it is desirable to retain a refer-

ence record of the mouth as it originally was, it is advisable to use a duplicate set of casts for diagnostic correction by the trimming and build-up method. The corrections made on the study casts serve as a graphic guide to the duplication of these corrections in the mouth.

If the diagnostic findings as determined from the casts indicate the necessity of altering the vertical dimension, the relation is opened to an indicated height mandibular movements can be established, thus minimizing the degree of vertical change.

A biteblock of wax or compound is constructed to maintain this tentative degree of opening. The final determination of the amount of vertical change is obtained by transferring the biteblock to the mouth, where it is used to check the modification of facial contour, and to establish sufficient clearance for the free-

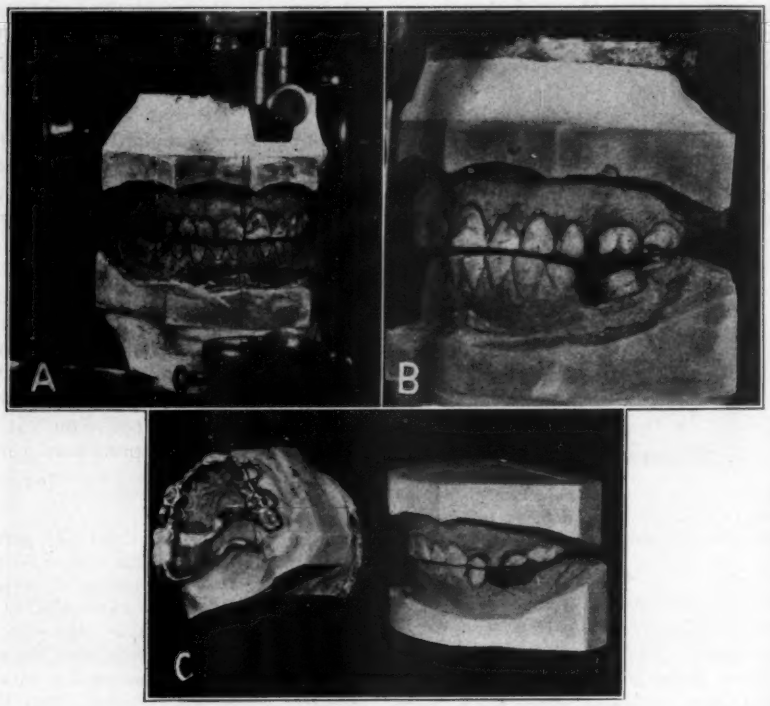

Fig. 3.—A, rotation of mandible caused by guiding incline, with painful condylar reactions. B, effect of interference of cusp points; i. e., lack of contact throughout rest of mouth. C, left, splint (presented by patient) incorrectly constructed in that increase in vertical dimension from insertion of splint did not eliminate guiding incline of lower molar. C, right, reduction of lower molar for occlusal harmony and balance, affording patient relief.

that will permit tooth clearance in all mandibular functional excursions. In many instances, particularly in cases of deep incisal overbite, a slight reduction of incisal crown length and a modification of incisal guidance may produce a closer jaw relationship from which free way space. It may also be used in determining roentgenographically whether the condyle head is in normal, anatomic position when the jaws are at this tentative degree of opening. (Fig. 2.)

To bring about a harmonious occlusion, one of two procedures may be fol-

lowed: reduction of the cusp height, where found to be excessive, or increase of cusp height where deficiencies or lack of occlusal contact are evident. If it is more conservative to reduce cusp height to achieve an equilibrated occlusion, this procedure should be followed.

In case of mutilation, attrition or irregular or excessive tooth wear, it may be necessary to restore the entire occlusal plane. (Fig. 1.) This type of mutilation is usually accompanied by a loss of vertical dimension and is frequently associated with painful sequelae in and around the temporomandibular joint. It is important to remember, however, that the disturbance in occlusion may be within the range of tolerance of condylar movements, and the patient may not experience any discomfort or pain. But when the disturbance presents any deviation from normal occlusal contact, even if it is but a single cusp incline steep enough that, in the excursions of the mandible, the condyle heads are strained beyond the range of tolerance, symptoms of discomfort will manifest themselves in poignant and oftentimes alarming reactions.[6]

It may be seen, therefore, that we cannot arbitrarily assume that the correction of any case of occlusal disharmony resolves itself into so-called "raising of the bite" exclusively, since the latter may have the effect of intensifying the severity of the discomfort when bite raising is not indicated. (Fig. 3.)

Should a change in vertical dimension be indicated as the procedure assuring an equilibrated occlusion, our aim should be to establish a plane of orientation at a point which will require the least change in vertical dimension.

The most important factor in any oral restoration is the redistribution of the applied forces of occlusion so that the resultant resistance to these forces will cause the least trauma to the teeth and their supporting structures and the temporomandibular joint. This can best be accomplished by equilibrating the cuspal relationship so that the teeth will function harmoniously in any mandibular excursion.

The roentgenogram can be used to register, record and demonstrate alteration of positions in the temporomandibular joint and as an aid in confirming clinical findings. It is valuable also in recording the condylar position when the vertical dimension is modified. The method for taking and interpreting such roentgenograms has been described by Riesner.[7]

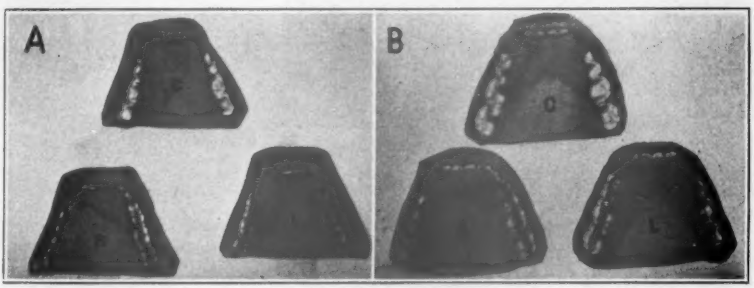

Fig. 4.—Wax bite registers taken in centric and right and left lateral position and showing premature or excessive contact areas and registrations after corrections. A, wax record before correction. B, record after correction; showing even greater cusp penetration.

No correction of a mutilated occlusion should be considered complete until recordings of the occlusion in centric and eccentric relation taken in the mouth prove the case to be in proper balance and free of cusp interference.

For years, men have been working on the problem of establishing and maintaining an equilibrated masticatory mech-

anism. However, it remained for Schuyler[8] to arrange in a lucid and orderly manner the necessary steps to proceed, on a workable, efficient basis, to record and correct occlusal discrepancies. His procedure may be summarized as follows:

The prime function of the jaw mechanism can be compared to the action of a series of blades visualized as "choppers" working against surfaces that might be designated as "chopping blocks."

The efficiency of the choppers, or cusp points, depends primarily on maintaining their sharpness of form. Therefore, the maximum efficiency of mastication will depend on how great a number of these sharply formed choppers can be employed at once.

In normal functional processes, the action of occlusion is not only in a vertical direction, but also in a lateral thrust. Therefore, to establish the greatest degree of efficiency, these choppers, or cusp points, must maintain their contact not only in centric relation, but also in all mandibular thrusts or excursions.

The first procedure is to establish maximum contact in centric occlusion. When this is achieved, vertical dimension also is established. We must then proceed to harmonize these contacts in eccentric excursions. If eccentric discrepancies exist, the inclined guiding planes should be ground and not the cusp points. If the cusp points are reduced instead of the planes, their contact is lost in centric occlusion, with a loss of vertical dimension.

The points of correction are determined from records of unstrained occlusal contact. Baseplate wax is used in preference to articulating paper, because it registers the points of conflict statically, as compared to the indistinguishable smudge of articulating paper, which would register areas past these points when the teeth glide into position in the registering process. It is of considerable help to employ wax recordings, especially in demonstrating the contact relation at any single point of an excursion in eccentric position.

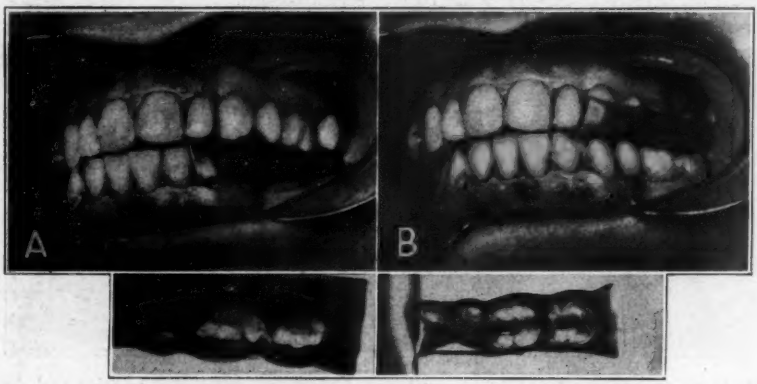

Fig. 5.—Method of registering occlusal discrepancies and making corrections. Thin areas in wax show where contact is made. A, balancing side record. B, working side record.

The baseplate wax is cut to the approximate shape of the arch, softened uniformly over a flame, placed within the mouth and gently draped around the teeth of one arch. The mandible is guided into a centric contact relation, and the patient is asked to close gently, stopping as soon as he feels the first contact of tooth with tooth. This is done to avoid the natural tendency to bite through the wax and deflect the mandible by cusp guidance and so register an incorrect and strained relation. (Fig. 4.)

The wax is removed after being slightly

chilled and is examined against the light for the degree of cusp penetration. If there is an apparent thinning or perforation of the wax, a premature contact exists, indicating that a cusp point is in conflict with its opposing fossa or guiding plane. When these points of premature contact in centric relation have been established, wax recordings are taken in the eccentric position to determine where relief of the point of interference is needed.

The decision as to where to make the correction is arrived at by following the principles of occlusal equilibration as suggested by Schuyler.[9] When this is done, the points of occlusal conflict that existed in the centric relation position have been adjusted.

Similar procedure is now pursued to record and correct discrepancies in occlusion in the balancing and working relation. To facilitate the correction of points of conflict, small strips of baseplate wax are used to register and "spot mark" these areas. (Fig. 5.)

These wax records may be used in the following manner: The wax strip is examined against the light, the thinned out or perforated areas being noted. This wax is replaced in the mouth so that the point of excessive contact may be marked through the wax on to the tooth with an indelible pencil at the point of penetration of the wax. The marked point is then ground with small stones. This process is repeated, being continued until that point of interference is relieved. The correction of one point of interference may reveal additional points of conflict that must be corrected.

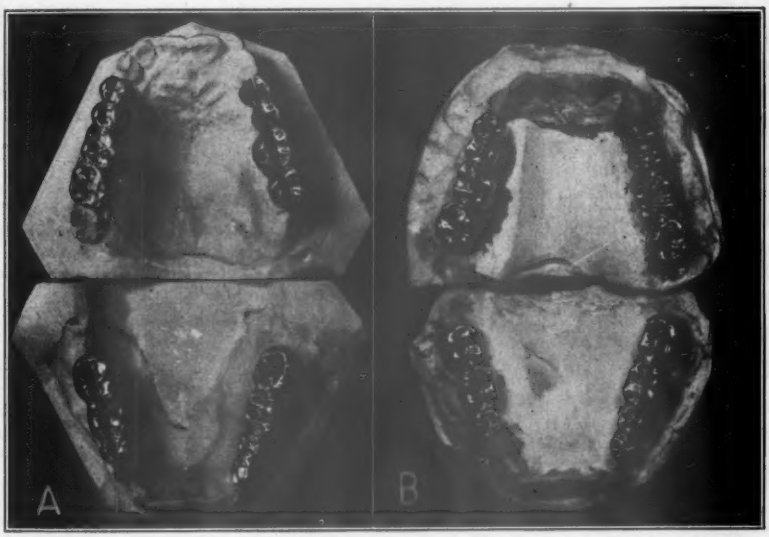

Fig. 6.—A, splints constructed to establish vertical dimension. They are used to protect teeth during cavity preparation and restoration. They are set in place with zinc oxide and eugenol paste. B, inlays restored to maintain vertical dimension established by splints.

In making these corrections, it is not necessary to complete the entire case at one sitting. After centric relation corrections have been completed, only one working side and its corresponding balancing side should be treated at one time, to insure an orderly progressive routine until the entire project has been completed.

In mouth rehabilitation, if no change in vertical dimension is contemplated, in-

terfering cuspal discrepancies of the natural dentition should be corrected before any restorative procedures are begun.

There are a number of acceptable procedures that may be employed in transferring the contemplated corrections to the mouth as outlined and planned on the study casts.[10] However, an orderly procedure requires the establishment of posterior cusp inclines that will be in harmony with condylar guidance and the established incisal guidance. (Fig. 6.)

Technics of different operators may vary, but the object of all operators in rehabilitating a mouth should be to reestablish harmony of function by redistributing the applied forces of occlusion so that the resultant resistance to these forces will cause the least trauma to the teeth and their supporting structures and the temporomandibular joint.

After every care has been exercised to establish oral health, maintenance of that state of health should be the goal. An equilibrated occlusion will serve as a considerable aid in maintaining a state of health.

SUMMARY

Knowledge of occlusion is a basic necessity in establishing procedures for mouth rehabilitation. A standardized procedure for diagnosis includes:

1. A clinical examination of the mouth.
2. The evaluation of habits as a factor in occlusion.
3. Registration of casts on an adjustable articulator.

In increasing the vertical dimension, a new plane of orientation must be established, somewhere between the position of physiologic rest of the mandible and centric occlusion of the teeth. The change should not be so great as to eliminate the free-way space of about 3 mm.

In mutilated occlusion accompanied by loss of vertical dimension, it is important to remember that the occlusal disturbance may be within the range of tolerance of condylar movements and the patient may not experience pain. However, condylar movement may be thrown into a range of intolerance, with accompanying pain, because of disharmony of occlusion no matter how slight.

No case should be considered complete until restorations are checked in the mouth. It is of considerable help to employ wax recordings, in preference to articulating paper, especially in demonstrating the contact relation at any single point of an excursion in eccentric position.

It cannot be arbitrarily assumed that correction of occlusal discrepancies resolves itself solely into a procedure of "raising the bite." Functional equilibration should be the prime consideration.

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745 Fifth Avenue.

SULFATHIAZOLE AND ITS USE IN INFECTIONS OF THE JAWS

By George C. Albright, D.D.S., Greenville, S. C.

THE great revelations in the art of treatment of human ills have not come to us in one spontaneous book of knowledge, but have been given to mankind in periods beginning with the early days in which Hippocrates' works were considered the last word in the practice of healing. Research did not stop with these works, but moved into the middle ages of medicine, the days of Louis Pasteur, who gave to the world the theory of immunization to diseases that had been fatal. Vaccines and serums were improved after Pasteur's great discovery. Many substances were produced that made medicine a more exact profession than ever before.

There was one foe that, at this time, had not been conquered, one that the medical profession dreaded and feared. This foe lurked behind every surgical operation and was ever present in the human body to strike at will and run its course unhampered. "Pyogenic infection" is caused by various groups of cocci, manifesting themselves in the human body in the form of pneumonia, streptococcic, staphylococcic and gonococcic infections, meningitis and various other types of specific and cross infections. These infective organisms took their toll yearly of great numbers of men, women, and children in all walks of life. From the infant to the aged, infection ran rampant with nothing to check it. Substance after substance was tried with little or no success, and discarded.

Read before the Section on Oral Surgery, Exodontia and Anesthesia at the Eighty-Third Annual Meeting of the American Dental Association, Houston, Texas, October 29, 1941.

In the year 1919, a Frenchman named Tréfouel and his co-workers at the Pasteur Institute in France found an aniline dye derivative, sulfamido-diamino-benzene, which, when acted upon by a series of changes in the animal organism, was changed into the substance now known as sulfanilamide. Sulfanilamide, a relatively simple white crystalline organic compound, has proved itself to be as effective in the treatment of beta-hemolytic streptococcic infection as red dye acriflavine and is almost devoid of toxic reactions. Furthermore, these workers found that this white crystalline part of the dye molecule was responsible for its effectiveness. There was very little reported on this aniline derivative from 1919 until 1935, when a worker by the name of Domagk revived interest in it and began new research.

This new drug was the source of a number of reports from Germany. It was described as one of a long series of dye compounds that had been synthesized in the hope of finding something of therapeutic use. The original evidence in its favor was based on experiments in which the development of streptococcic infections in mice was prevented by its administration, and there had been a number of clinical reports of its effect in acute streptococcic infections in man. From this stage, the drug, sulfanilamide, was the subject of constant study and experiment. It proved itself clinically to be almost a specific in pneumonia, streptococcic infections, meningitis, gonorrhea, erysipelas and scarlet fever. Sulfanilamide was used in virtually all types of infection, but was found to be most ef-

fective in streptococcic infections. This wonderful new drug was not without its drawbacks for in some cases its use produced varied and severe types of toxic reaction.

Since sulfanilamide was a new drug and individuals reacted differently to it, it was difficult to determine the exact dosage. Therefore, patients had to be observed closely while the drug was being administered. Some of the most common complications were nausea, dizziness, cyanosis and skin eruptions. Cases have been reported in which the drug was responsible for direct changes in the blood, as in acute hemolytic anemia and in agranulocytosis.

The scientific world was amazed at the results of the use of this aniline dye derivative. They investigated farther this particular aniline group and the result was the development of sulfapyridine (2-sulfanilamidopyridine), a derivative of sulfanilamide. Sulfapyridine has proved to be just as effective in the treatment of the above-named infectious diseases, with markedly less toxic reactions. This new derivative of sulfanilamide then became the popular preference when an aniline dye derivative was to be used. Not yet had the chemist compounded a drug that was of any great value to the dental world in dealing with jaw infections. Most infections of the jaw originate from the teeth and surrounding tissue, and these tissues seem to show a marked affinity for infections of the mixed type instead of the true type infections. A bacterial picture of the mouth will present a general mixture of nearly all the infectious organisms, streptococcus, staphylococcus and the spirochete of Vincent, with a predominance of staphylococcus. Sulfanilamide and sulfapyridine, when given in mixed type infections, show results only when streptococci predominate.

In the latter part of 1939 and the first part of 1940, a derivative of sulfanilamide which was an analogue of sulfapyridine appeared. It was given the name sulfathiazole. This drug has been in existence only a short time, but, I am convinced, is to play a major rôle in the treatment of jaw infections, especially of the acute type; namely, the cases of sore and infected lower third molars which are so prevalent, osteomyelitis of the mandible and maxilla and acute periapical and periodontal abscesses. I first became interested in this drug in the spring and summer of 1940, when it made its appearance.

My first knowledge of the drug came from an article stating that this drug had a definite and drastic action upon *Staphylococcus aureus*, the organism that causes the dentist great concern in mouth infections. These acute infections are cross or mixed infections in which the staphylococcus is the predominating factor. Sulfathiazole acts on the staphylococcic organisms by saturating the blood and prohibiting the growth of bacteria. After the growth is markedly retarded, the old organisms lose their virulence and die, and thus the patient is freed of the infective organisms and health is restored. Sulfathiazole does not kill bacteria, but retards their growth, the natural bodily resistance taking care of the few remaining infectious organisms. Sulfathiazole is still in the experimental stage. During its short use, it has proved effective with a minimum of reaction.

I have a report of approximately fifty cases which I should like to discuss briefly. For the sake of compactness, I have classified the various maladies for which sulfathiazole was given.

1. Acute inflammation around third molars, with pain, swelling and, in some cases elevation of temperature, 27 cases.
2. Infection following compound fracture of the mandible, 2 cases.
3. Periodontal abscesses, 4 cases.
4. Apical abscesses, 6 cases.
5. Acute jaw infections with pain, swelling and tendency to deep bone infection, 5 cases.

6. Temporomandibular joint infections, 3 cases.

7. Acute infection following tooth extraction, 6 cases, 1 child, 5 adult.

Time and space will not permit me to discuss each case. I shall indicate the cases in groups, giving a general description of each.

1. Inflammation around third molars: Nearly all twenty-seven cases responded at once to the administration of sulfathiazole. There was a marked reduction in pain, swelling and discomfort in from twenty-four to thirty-six hours. In a majority of cases, the tooth was removed on the fourth or fifth day. No local treatment was used before extraction.

2. Compound fracture of the jaw followed by infection: The patient was at once put on sulfathiazole, the dose being two 7.7 grain tablets, or 1 gm. every four hours until twenty-four tablets had been taken. This was a larger dose than usual. The inflammation subsided in about thirty-six hours, and the patient was completely comfortable. During the time that the case was under treatment, there were two more flare-ups, which responded at once to sulfathiazole therapy.

3. Periodontal abscesses: In the four cases of periodontal abscess in which sulfathiazole was administered, there was a decrease of pain, with an early tendency to localize.

4. Periapical abscesses: In the six cases of periapical abscess, there was not a very marked response to the drug. Pain did not subside readily, but inflammation did subside. There was no tendency for the infection to spread. There was a tendency to early localization. Of the various mouth infections, apical abscess is, I believe, the most resistant to sulfathiazole.

5. Acute jaw infections with a tendency to deep bone infection: When an acute infection probably originated in a carious tooth with swelling of the soft tissue and pain, sulfathiazole was given. There was a reduction of pain and swelling, with a return to normal in from thirty-six to seventy-two hours.

6. Temporomandibular joint infections: Of the three cases of temporomandibular arthritis, two responded to sulfathiazole. One case showed no response, but required stabilization by intermaxillary wiring.

7. Acute infection following tooth extraction: Two cases were in children. There was a marked response to the drug and all the cases responded in from eighteen to twenty-four hours.

Sulfathiazole also has its merits in local applications to sockets immediately following tooth extraction. In more than 300 cases, I am convinced, healing took place more readily, with less after-pain and with very few dry sockets. I use it routinely in all third-molar sockets and in sockets where after-pain is to be expected.

In dry sockets, there does not seem to be any response to sulfathiazole when packed into the sockets or administered internally. I have found that by establishing a new blood clot in which sulfathiazole is incorporated, pain is relieved and healing takes place rapidly.

LOCAL APPLICATION OF SULFATHIAZOLE IN COMPOUND FRACTURE OF THE JAW

Recently, I used the drug in eight cases of compound fracture of the jaw, placing it in the break, and, at present, I have had but one case of infection following reduction.

In administering the drug internally, a small dose seems to be sufficient to control most jaw infections. For adults, the dose is one 7.7 grain tablet, or one 0.5 gm., taken every four hours during the day until sixteen tablets have been taken or the results are satisfactory.

For children, one 3.85 grain tablet, or one 0.25 gm., is given every four hours during the day until results are satisfactory, which is usually in from twelve to twenty-four hours.

In the local application of the drug,

one 3.85 grain tablet is moistened and placed in the socket. It readily mixes with the blood and a slight hemostatic action results. A sponge is placed over the socket and a clot of sulfathiazole and blood forms. The patient is advised not to use a mouthwash for at least two days. In impacted third molar cases, two or three tablets are placed in the socket. In three days, the socket is irrigated and more of the drug is placed in the socket. Two applications are usually sufficient to assure speedy recovery without the usual postoperative complications.

CONTRAINDICATIONS

The use of the drug is contraindicated when there is marked renal insufficiency, since the drug is eliminated by the kidneys. Since the drug may cause reduction in the white cells and also destroy some of the red cells, in patients showing abnormality of the blood a blood count should be made daily, especially when there is toxicity and when larger doses of the drug are being administered.

The toxicity of sulfathiazole is less than that of sulfanilamide or sulfapyridine. The toxic reactions are the same; namely, dizziness, nausea, skin eruptions and, in some cases, a marked change in the blood itself. Sulfathiazole is still under experimentation. The literature is still meager. The drug is not a cureall, but promises to win recognition and demand the respect of the dental as well as the medical profession.

206 East North Street.

WEAR OF ACRYLIC RESIN TEETH
(PROGRESS REPORT)*

By JOHN R. BEALL,† B.S., Washington, D. C.

INTEREST in the use of acrylic resin for inlays, bridges and jackets and for the teeth in full and partial dentures is increasing. Articles[1] have appeared in the dental literature describing some of the properties of the resin as used for teeth and listing advantages to be obtained through its use.

Among the advantages claimed for the material are: 1. A more natural appearance than that of porcelain. 2. Less friability than porcelain. 3. A more natural "feel" to the patient on contacting opposing teeth. 4. In dentures, a better bond between the teeth and the base material.

Disadvantages mentioned include (1) low surface hardness as measured by the Brinell or similar tests, (2) insufficient strength in thin sections, (3) a change in dimension with change in water content, (4) loosening of cemented crowns and inlays and (5) the possibility of excessive wear.

While there has been much discussion as to the possibility of excessive wear, no laboratory data have been made available on which to base a satisfactory conclusion. Early in 1942, the American Dental Association Research Fellowship at the National Bureau of Standards decided to attempt to evaluate the wear of these acrylic resin teeth through a study of such teeth in actual service in the mouth.

CONSTRUCTION OF CASES

Patients who would be readily avail-

*A report to the Research Commission of the American Dental Association.

†Research Associate of the American Dental Association at the National Bureau of Standards.

able for recall at desired intervals were selected by the dental research laboratory at the National Bureau of Standards. Full upper and lower dentures were made for these patients. The base material and the acrylic resin teeth (a commercial brand, on the market) were supplied by the American Dental Association Research Fellowship.

In the two cases reported here, one patient (Case 19) chews tobacco regularly, while the other (Case 17) smokes cigarets, but does not chew tobacco. Thus, the former may represent severe service and the latter normal service. In both of these cases and a number of additional ones to be reported later, Luzerne G. Jordan, of Washington, D. C., cooperated.

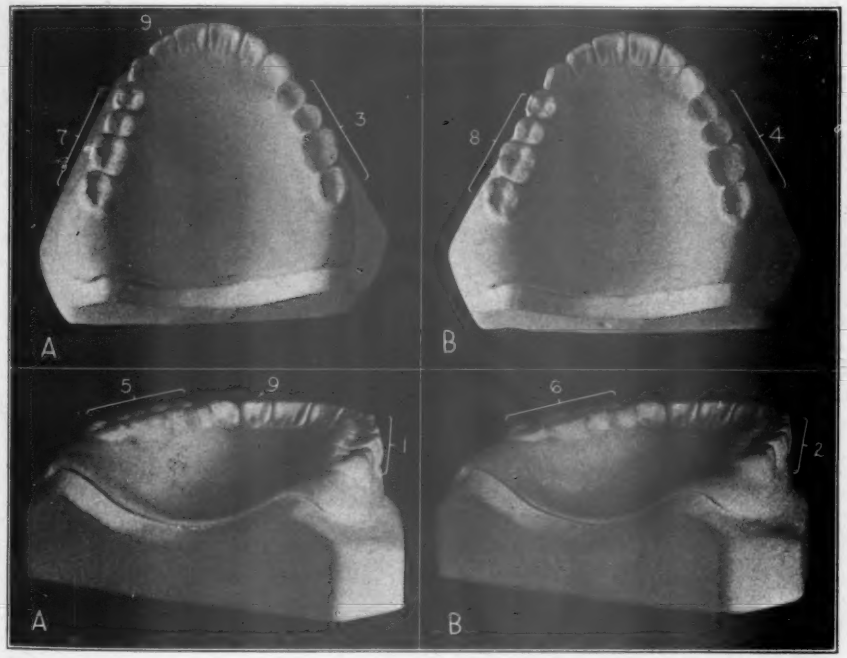

Fig. 1.—Replicas of upper denture, showing wear of acrylic resin teeth. A, at beginning of service period. B, after seven months.

EXPERIMENTAL DATA

The following program was planned to obtain records of the condition of the teeth at various times during the test, and in the hope that measurements could be made of changes as they occurred.

1. After the cases had been constructed and all the necessary adjustments made to the satisfaction of both the dentist and the patients, dental "stone" models were prepared by pouring the stone directly into the base of the denture. The models were so prepared that a record of the entire periphery of the base was included. The base of the model in each instance was made parallel to the occlusal plane of the teeth by placing the denture occlusal surface downward on a plate of glass. The base of the model was finished by pressing down another plate of glass on the unset stone, the second plate of glass being kept parallel to the first by a form of uniform

depth used to shape the sides of the model.

2. When these models had hardened, they were removed from the form and the denture was removed from the model. Relief of the model was necessary in the case of undercuts. The models, prepared by pouring directly into the dentures, obviously, fitted accurately at the beginning of the test.

3. Each denture was replaced on its model and the denture and model together were duplicated in stone, with hydrocolloidal impression material. Thus, a stone replica of each denture on its model, with the occlusal plane parallel to the base, was obtained at the start of the test period. (Figs. 1 and 2.) Reproduction of detail was quite satisfactory.

4. The models and replicas were stored in a closed container maintained at 32 per cent relative humidity.

5. On recall of the patient, the denture in each instance was replaced on its model, the fit noted and a second replica made, as in paragraph 3, above.

6. These second replicas were stored in the container for from twenty-four to forty-eight hours prior to measurement.

7. All models and replicas were made from "albastone," white, from the same can and with the same water : powder ratio, in order to eliminate as nearly as possible any effect of expansion of the stone.

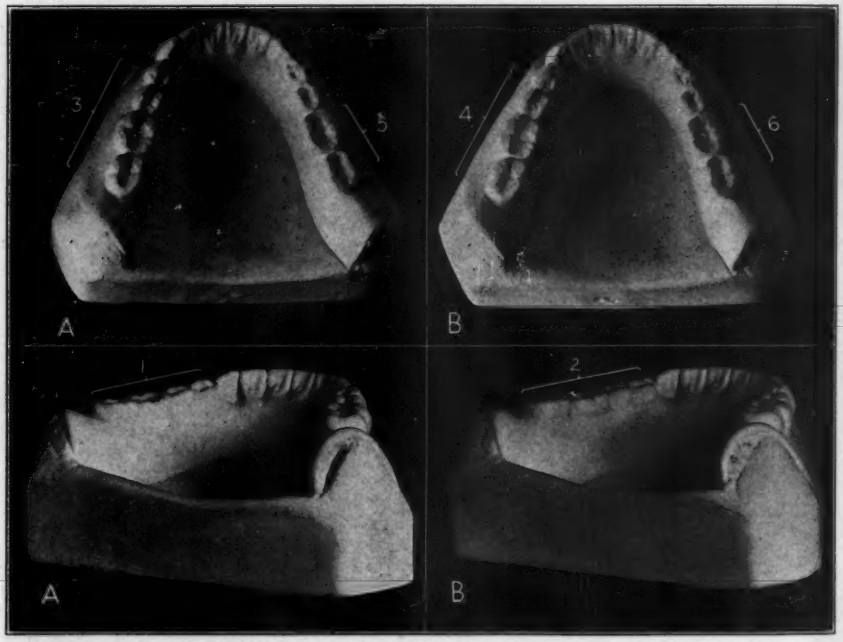

Fig. 2.—Replicas of lower denture showing wear of acrylic resin teeth. A, at beginning of service period. B, after seven months.

The first replicas of Case 17 were made April 16, 1942, the second set August 12, 1942, representing a period of use of approximately four months. Case 19 was in service approximately seven months, the original replicas having been made January 20, 1942, and the second set August 13, 1942.

MEASUREMENTS ON OCCLUSAL SURFACES

Wear of the tooth surfaces was determined by differential measurements on the replicas made on the dates mentioned above; that is, a point on the replica near the tooth surface to be measured was selected, in an area normally expected to be free from wear, and the vertical distance between this point and the tooth surface was determined on both the "before" and the "after" replicas. If this distance was less (where the reference point was below the occlusal surface) in the case of the stone replica made at the end of the period, the occlusal surface had worn.

Measurements were made in this way, with a surface plate and depth gage to the arm of which was attached a dial indicator with the plunger vertical. A special foot was made for the plunger, terminating in an inverted truncated cone with an included angle of approximately 60 degrees and a diameter of about 0.015 inch at the small end. This was used since a sharp point would have dug into the stone.

The results of these measurements are presented in the accompanying table. It is believed that the method employed yields results accurate to ±0.005 inch or better. Thus the values with a ‡ in the table (where the tooth had increased in vertical dimension) should be taken to mean that no wear had taken place. Any value in the table over 0.005 inch, however, would indicate that the tooth had changed at that point. Values reported are based on measurements from a selected reference point to the high point of each cusp as indicated by the table headings. In some instances, the high point had worn away and contact had shifted laterally as new facets were worn on the teeth. No allowance for this lateral shift was made, although it is believed that the wear indicated in the

WEAR* OF ACRYLIC RESIN TEETH

Case	Tooth	Loss of Vertical Dimension† in Thousandths Inch on Cusps as Indicated			
		Mesial-Buccal	Mesial-Lingual	Distal-Buccal	Distal-Lingual
No. 17 upper 4 months service	Right 2nd molar	0	7	1‡	
	Right 1st molar	2‡	10	1‡	9
	Left 2nd molar	6	13	6	
	Left 1st molar	1‡	7	0	5
	Left 1st bicuspid	Lingual 2	Buccal 0		
No. 17 lower	Right 1st molar	5	2	5	3
	Left 2nd molar	4	4	6	4
	Right 2nd bicuspid	Buccal 0			
No. 19 upper 7 months service	Right 2nd molar	8	8	5	6
	Right 1st molar	6	18	5	7
	Left 2nd molar	6	21	7	
	Left 1st molar	12	28	15	8
	Right 2nd bicuspid	Lingual 10	Buccal 10		
	Left 1st bicuspid	Lingual 19	Buccal 16		
No. 19 lower	Left 2nd molar	12	4	17	4

*As represented by loss of vertical dimension.
†From differential measurement on stone replicas (reference point to high point of each cusp).
‡Vertical dimension greater after service. The probable accuracy of determinations is ±0.005 inch.

table is less than the actual wear, in certain instances, as a result of this shift.

Figures 1 and 2 show the result of service on the dentures of Case 19. In each instance, the letter A indicates the original replica and the letter B the later one. A careful study of these photographs will reveal the change in angle and size of facets, as well as the development of new facets on the later replicas. Figure 1 shows two views of the replicas of the upper denture of Case 19, indicating the change in inclination of the working surfaces and the relative shallowness at B, shown in the areas marked 1 and 2 of the lower views. This is also indicated by the changed shadow pattern in the same area of the upper views (3 and 4). The profile of the molar and bicuspid area, 5 and 6 in the lower view, appears to be flattened in the case of B (6). The upper view of the same teeth reveals that the pitted areas have increased and that some of the facets noted on A (7) are distinctly larger on B (8). Close examination of the first and second bicuspid and first molar (3 and 4) reveals the almost complete loss of anatomic detail in these teeth.

The facets on the anterior teeth appear larger in general in B. The chip (9) in the lateral incisor occurred in preparing the replica and was not on the denture.

Similarly, in Figure 2, 1 and 2, and 3 and 4, show the flattening of the cusps, while enlargement and change of the facets may be noted on other teeth (5 and 6).

The effect in Case 17 is not so pronounced, and would not show in halftone reproduction, although one may readily detect it when studying the replicas.

CONCLUSION

It is believed that the amount of wear shown in the illustrations and measured and reported in the table is of sufficient magnitude to warrant reporting to the profession even though comparable figures and information on porcelain teeth or natural teeth are not available at this time. Exposed occlusal inlays and crowns of acrylic resin, also, may be expected to wear. These experiments do indicate that wear takes place at an appreciable rate. A rough calculation shows that, if wear on a certain molar area in the case of the patient who is addicted to chewing tobacco were to continue at the present rate, the tooth would be worn to the level of the base material in approximately three years.

A similar study of the wear of porcelain teeth will be undertaken. Only when comparable values are available for porcelain will one be able to make an intelligent direct comparison, and to decide whether the balance of advantages and disadvantages warrants unrestricted use of acrylic resin teeth. Until such time as reliable data are available, as a basis for judgment, it is suggested that the practitioner continue to warn his patients that acrylic resin teeth are "experimental" rather than permanent.

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A STUDY OF DENTAL CARIES—ITS IMPORTANCE IN RESTORATIVE DENTISTRY

By F. W. Hinds,* D.D.S., Dallas, Texas

THE fight against dental disease has been going on for many years. Within the past decade, there has been a great increase in interest in dental research. At the recent meeting of the International Research Association, 112 papers were presented.

You may wonder why I bring up the subject of dental research, or why one who has spent his professional life in restorative dentistry should feel the urge to discuss the histology and pathology of the teeth. I assure you that I shall confine my discussion to the practical aspect of the question. I do wish to say a word, however, for that large group of men in the dental profession who have spent their lives attempting to repair the ravages of dental disease.

Samuel P. Capen, chancellor of the University of Buffalo, in a paper presented this year at the meeting of the American Association of Dental Schools held in New York City, said that dentistry should rightly be an autonomous profession. He also stated that the dentist is part engineer and part biologist. I assume that he called us engineers because no mind except that of a straight-thinking engineer could successfully plan and carry out the restorative dental work done today—work subjected to the stress and strain that such fabrications must withstand.

I assume that he called us biologists because such work must be planned by persons who know something about biologic laws, else reconstructed mouths would not remain in a healthy condition. Many of our friends who are overbalanced on the biologic side say that we have offended humanity with an overdose of mechanics; and those of us who are too mechanically inclined may have failed miserably in diagnosis and in end-results.

Those who say that the dental profession has overlooked the scientific study of dental disease and dental tissues have not read the literature. Let them study the work of such men as Miller, Black and Williams and, in more recent years, Gottlieb, Orban, Kronfeld, Bunting and others. Many of these men were eminently successful in the field of operative dentistry.

It is my opinion that every thinking dentist spends many hours of his time in study of the histology and pathology of the structures upon which he operates. There is, I believe, one outstanding fault that dentists must admit: We do not spend enough time in reading. Research in the past has been limited, and probably that of greatest value has been accomplished in private offices. Even today, we find lone workers in the vineyard attaining astounding results, but because they may not have a university connection, they report their findings only after a feeling of timidity or modesty is overcome.

Twenty-five years ago, in discussing the practice of dentistry, a man who had graduated fifteen or twenty years earlier informed me that he rarely filled a tooth that did not have an exposed pulp. In fact, he said, patients rarely came to him

Read before the New Jersey State Dental Society, May 7, 1942.

*Dean, Baylor University, College of Dentistry.

before they were in pain. His policy was to save the bad apples while the good ones were preparing to become candidates for salvation. His diagnosis was simple: the patient had to feel the cavity or the dentist had to smell it. A spoon excavator would have been of far more value to this dentist as a diagnostic instrument than would bitewing films. At the other extreme, one of the finest operators in this country told me that he could find any cavity that existed with the aid of a properly made explorer. Let us see whether we have progressed.

The x-rays came into common use about 1915. At that time, our technic was immature and most of us interpreted the pictures poorly. We could detect tooth structure to restore that little dark area that appeared in the film. Some teeth were allowed to go untreated for another year, but, after a few of these innocent looking spots enlarged rapidly within a few months, we became more thorough in our work and restored more proximal cavities. Upon cutting into them, we often found that the innocent-looking spot was not so simple, but was the signpost of extensive, undermining caries.

Now let us compare some of our x-ray films with photomicrographic pictures of the same teeth. The effort to detect beginning carious lesions by means of the x-rays is based on the idea that beginning caries is identical with decalcification.

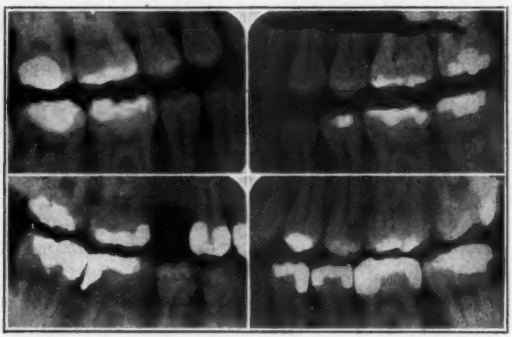

Fig. 1.—Bitewing x-ray films showing numerous cavities of different degrees of progress.

pockets, cystic areas, etc. More often than not, the pictures were placed in an envelope, not a film holder, and we looked them over until we found a tooth that looked bad, and attacked it. Over a period of years, we have learned to take better pictures and to read them in a more intelligent manner.

Today, the bitewing film is one of our greatest aids in diagnostic work. It enables us to find cavities, especially proximal cavities that we could not find with an explorer. I say this without fear of contradiction. At the beginning of the bitewing film era, many of us hesitated to cut into what appeared to be sound

Checking x-ray pictures of teeth against cross-ground sections made from the same teeth yields surprising facts. Teeth in which the early carious process is shown in the ground section as having penetrated the enamel and affected the dentin do not show any changes in the x-ray picture.

This failure is to be explained by the fact that the process is not identical with decalcification. It is a proteolytic one. The enamel, consisting mainly of inorganic matter, resists the process far more than dentin. The enamel surface can be intact and caries traveling through an enamel lamella can already be at work

in dentin. The enamel does not show any changes either on clinical examination or in an x-ray film. The loss of mineral salts is relatively small and does not represent the beginning stage.

The x-ray picture shows only changes in inorganic matter; therefore, decalcification must have progressed to a considerable degree before the usual x-ray film is of any diagnostic value. Applebaum[1] has been able to show early decalcification by means of soft x-rays in ground sections, a method that we are unable to use clinically.

A study or comparison of a number of these apparent instances of beginning dental caries will disclose their extent and will give us a better understanding of what has been called incipient decay;

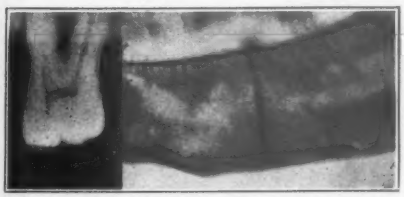

Fig. 2.—Beginning enamel caries not evident in x-ray film. Cross-ground section reveals the lamella. Outside of contact plane in color, decay was shown by yellowish brown hue (not seen in x-ray film).

and, with such an understanding, we can advise the patient in a far more intelligent manner. There is an urgent necessity for filling carious teeth, and doing it as early as possible.

No one can accurately estimate the possible damage done to pulps by deep restorations. It is a subject that I not only hesitate to discuss, but also dislike to think of at all. It is such a hopeless situation: we have no means to determine whether a pulp is partially dead. Those of us who have filled many root canals in the past know that in multi-rooted teeth we have many times found one or more of the roots pulpless. Neither the pulp tester nor the x-rays will clear up this problem.

Root-canal work is coming back. But is it not far better to restore teeth early than to await the time when it is necessary to remove the pulp? Frequent examination and good restorative work are the best methods of protecting the pulp. In a properly managed practice, such efforts result in saving teeth and maintaining oral health. It is too bad that we cannot make microscopic examinations of teeth in the mouth. If we could, more teeth would be saved. But let us not despair, for more frequent and intelligent use of the x-rays will aid us in obtaining more favorable results.

Such a policy of frequent examination and the early restoration of carious areas will prolong the life of the teeth as well

Fig. 3.—X-ray film showing no change. This cross-ground section reveals caries of the enamel extending into the dentin. There is no loss of tooth substance. Caries is indicated in the section by yellow pigment.

as the general health. Many persons who lose the teeth between the ages of 30 and 40 years should have retained them until long after 50. We know this to be true because we see instances day by day and year by year in properly conducted practices. So many individuals today are losing their teeth at an early age because we have failed to carry the gospel of good dentistry to the public, or, perhaps I might say, we have failed to convince them that our services are worth while. The matter of the draft examinations has been brought to our attention many times, and we have been accused by the public of being remiss in our duty in that

we have failed to improve standards since the first world war. The charge is probably justified, but a fair comparison can hardly be made from available statistics. The standards of the one examination were entirely different from the standards of the recent draft requirements. By the same token, we might assume that we have suddenly raised the standard of dental health since Pearl Harbor, for, it is my understanding, the Army will accept a draftee today if he can eat at all (provided a great deal of infection is not present), and if he could not eat, he would not be able to take the examination.

In order that we may progress, the dental profession may as well admit that we have failed to carry good dental service to the great masses of the people. Such an admission will place us in a far more advantageous position to progress.

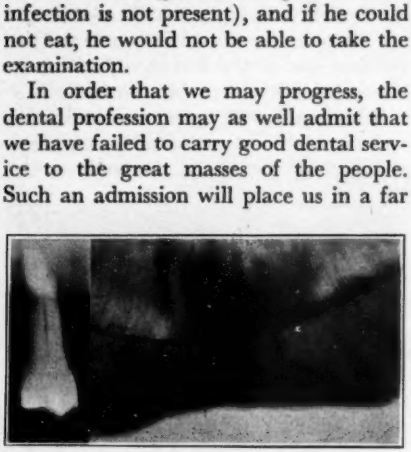

Fig. 4.—X-ray film showing defect due to abrasion of contact plane. The cross-ground section shows abrasions and caries within in the contact plane extending into the dentin. There is shrinkage of the dentin.

Such progress, as mentioned above, can be made only by a determined effort on the part of the profession, and it will require not only education, but satisfactory dental service as well.

When people believe that dental care is worth while, they will buy it as they buy shoes and radios. They will also find the money to pay for it, as they do for other utilities, some of which are far less important.

But we are drifting: let us get back to the patient in the fifties. I am sure that most dentists have observed the tremendous increase in gingival cavities at this age. I quote from Orban:

The building of cementum is a continuous process. (G. V. Black.) New layers of cementum are laid down successively, and in this way the connective tissue fibers of the periodontal membrane become more and more firmly embedded. The retention of the tooth, as Gottlieb has pointed out, is dependent upon this continuous building of cementum.

The alveolar bone develops subsequent to the deposition of cementum. The connective tissue fibers of the periodontal membrane become connected with the tooth through cementum. The tooth, while it is in the process of eruption, transmits this stimulus of eruption through the connective tissue fibers to the surface of the bone surrounding the teeth. As a result of this stimulus, new bone trabeculae are laid down and form alveolar bone.

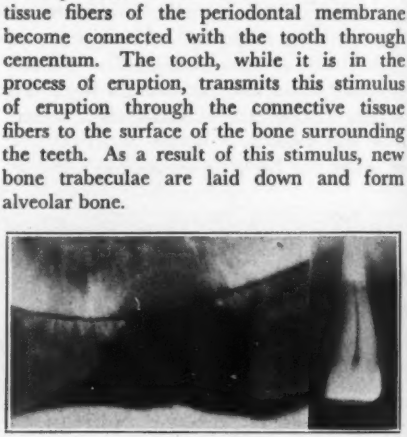

Fig. 5.—X-ray film showing concave abrasion of contact surface; cross-ground section, the same. There is caries of dentin, with shrinkage.

It must be understood that the cementum is built by the connective tissue of the periodontal membrane and that it may also be resorbed by it. The cementum is a living tissue. It has a metabolism and, as the recent experiments of Fish have shown, a lymph circulation. The cementum may be resorbed by the surrounding connective tissue and may be reformed if the cause of the resorption has subsided. In the morphological structure as previously described, there is little difference between bone and cementum, but according to the investigations of Gottlieb, we are convinced that there are remarkable differences in their biologic behavior. Continuous resorption and new building of bone is a physiologic process.

But the resorption of cementum is not so common.[2]

In older patients, recession of the gingival tissue takes place even if there are no periodontal pockets. It is apparent that when the connective tissue is gone, the deposition of cementum above the crevice ceases, and gingival cavities often develop.

A soft tooth surface has been exposed to external influences for one-third of the surface; namely, the cementum and dentin, which consists of organic matter. Enamel contains only from 3 to 5 per cent of organic material. Is it not strange that all areas so exposed do not become carious immediately? For some unknown reason, the majority of such exposed root surfaces remain intact. We are prone to believe that some kind of impregnation by the saliva protects these exposed parts.

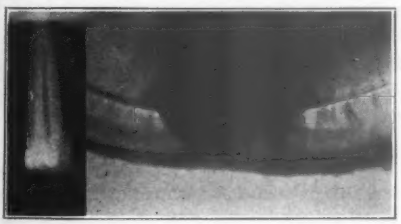

Fig. 6.—X-ray film showing slight defect. The cross-section shows enamel caries without loss of tissue substance and extensive undermining dental caries.

People in good health seem to have this protection. Persons of lowered resistance apparently have lost it, probably from a change in the quality of the saliva.

I make this statement not as a truth, but merely as an observation. Such cavities are difficult to control. Failure to control them quite often leads to misunderstanding, but a more thorough knowledge of the pathology of the tooth structure will again lead to a more intelligent discussion of this condition with the patient.

The subject of impregnation of tooth surfaces is constantly receiving more attention. We have seen the same principle used on telephone poles and railroad ties for many years. It has been used by the dental profession for many years, the agent being silver nitrate. Silver nitrate has its disadvantages, one of the greatest of which is discoloration.

Gottlieb's report at the International Association for Dental Research is of intense interest. I might add that the results of his work are far more encouraging than he has been willing to admit. His use of a compound of silver nitrate with indigosol has reduced the *Bacillus acidophilus* count to a point that would indicate some very important results from his work.

Perhaps the day will come when impregnation will become a prophylactic procedure, attacking beginning caries and gingival cavities, which are so hard to control. What progress could be made if it were possible to restore a mouth and give the patient reasonable assurance that the teeth could be maintained over a period of years! This is especially true in the case of those patients who are nonresistant to the ravages of dental disease.

G. V. Black could not have laid down the principles of cavity preparation in such an intelligent manner without an intimate knowledge of the histologic structure of the teeth. On the engineering side, it is as important to understand the retention, stress and strains that tooth structure will withstand as it is to understand the physical properties of materials used in restorative work.

Quite often, we fail to recognize that excessive strain and stress are present, or that restored areas are subjected to pressures of from 100 to 300 pounds, or even more. The muscles of mastication can place tremendous pressure or torque on fillings and on fixed bridgework.

Another biologic fact that we occasionally overlook to our sorrow: Fragile work will not stand up. Its consequent failure is another link in the chain of events that spells failure to dentistry and

causes the patient to say that it does not pay. I have the greatest hope for the success of the acrylic restorations that are being made with such reckless abandon at the present time. A more thorough study of their physical properties should be made as an aid in determining whether they have those qualities that will stand the continuous grinding and grueling that they will be subjected to in the mouth. We need them for esthetic effects, but failures will be costly. Thus it is that the constant battle between conservation and progress is ever on; but let us remember that we have been called engineers, and let not our enthusiasm for esthetics overcome sound principles of physics.

Progress must go on, and if the materials now at hand do not meet the requirements, let us with the aid of the chemist find new ones that will. This is an interesting age. Where there is a need or a want, the ingenuity of man meets the requirements. Progress is the word. Let us save more teeth. Let us have both better biologic and better mechanical dental service. Let us not blush with shame because we have been good mechanics: let us advance and become better engineers and biologists.

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CENTRIC AND FUNCTIONAL BITE RELATIONS

By RALPH H. BOOS, D.D.S., Minneapolis, Minn.

A STUDY of intermaxillary relation, or the bite, in edentulous cases is a basic aid in restoration of tooth arrangement to harmonize with the physiologic function of the masticatory apparatus.

Synchronizing the tooth arrangement to the physiologic function means more comfort and efficiency as well as a possibility of maintaining the alveolar ridges.

The physiologic function could be considered fundamental and the tooth arrangement technic for it is a personal method of procedure designed to include fundamentals.

In consideration of the fundamentals of intermaxillary relation, the mechanics of the relation has been looked upon as three dimensional, including height, width and depth. This may be analyzed as height referring to vertical dimension, and depth and width referring to the anteroposterior relation as well as to the lateral relations and arcuate movements.

Vertical dimension, referred to as the nose-to-chin distance, has been discussed in a previous paper. My approach has been to find the maximum force dimension and use this as a reference point for setting the distance. This technic is still being used, as the results have been most gratifying.

In this paper, the discussion will be limited to centric relation and eccentric function. Dividing the horizontal position into centric relation and functional relation, we have two fundamentals which may be involved as factors in denture construction. Centric relation may be defined as the most retruded position of the mandible at which the lateral

movement starts. Functional relation is the intermaxillary position to which the force is directed in mastication. This has been generally assumed to be centric relation. Many have thought that the greatest force is always exerted at centric relation. Eccentric function may be defined as in a functional area that is not centric relation.

With this in mind, an experiment was conducted that would provide free registration of the mandible and a definite check on the biting force. Edentulous patients were secured and impressions taken with the plan in mind that bases would be built and a gnathodynamometer mounted to check the various registrations of biting force.

A gnathodynamometer with a central bearing point was mounted on the lower base. A flat steel plate was mounted on the upper palate, providing an approximate central bearing point with the central bearing carried on the flat plate. No restrictions were put upon movements of the mandible in a horizontal plane.

The patient was instructed to bite as hard as possible in any position that was comfortable. These recordings were continued until a recording of maximum force was made and a group of power points assembled to locate definitely the position of the mandible during this biting test.

The gothic arch tracing was then recorded in the same case by placing a black film over the bearing plate and having the patient complete the extended movements of the mandible. The tracing was developed by the central bearing point of the gnathodynamometer, which was in the same position on the same base that was used in locating the power points. The upper flat plate also remained on the same base in the same position. In this way, a two-dimensional graph was constructed having the apparatus in the same relative position. The power points indicated the position at which the patient made a free registration of biting force. The gothic arch tracing provided the extensions of the mandibular movements in a horizontal plane. In many cases, it was found that the power points were not in the vicinity of the apex of the gothic arch. This seemed to indicate the possibility of an eccentric functional position.

To check further as to whether the power points were actually the positions of greatest biting force, the patient was asked to move the mandible in the vicinity of the apex of the gothic arch and record a biting force. The comparison of the biting force registered at the free position with that registered at the apex of the gothic arch was very interesting when the possibility of function in denture occlusion was considered.

Patient A recorded 52 pounds maximum force in the eccentric functional position. At the apex of the gothic arch, a registration of 32 pounds was recorded. The patient also complained of being rather uncomfortable and preferring not to bite in that vicinity. Patient B recorded a maximum force of 32 pounds in eccentric functional position. At the apex of the gothic arch, the same patient recorded a maximum biting force of 21 pounds. This patient also complained of being rather uncomfortable.

Experiments were continued on many cases, testing specifically the functional relation, and a good percentage of patients recorded eccentric functional points with a greater biting force than that registered at the apex of the gothic arch.

In the regular procedure of registering the intermaxillary relation by means of the gnathodynamometer, the power points are automatically registered in making the vertical dimension. In checking this to the gothic arch, it was found that usually about 32 per cent of the cases indicated eccentric functional relation. This percentage may vary, since many of the cases recorded were so-called trouble cases, and the average might not run as high on a more general level.

However, enough cases developed eccentric function to warrant the direction of definite attention to this factor in denture construction.

Most of the time, the position of the power points was lateral, although, in some cases, it was directly protrusive from the centric relation. The position of the power points varied from 1 to 7 mm. in a protrusive relation.

Almost all cases of a marked retrusion of the mandible in relation to the maxilla indicated a protrusive functional relation.

The histories of the cases were noted in an attempt to determine a logical reason for this eccentric function. In many cases, the patient previous to extraction lacked posterior teeth or replacement of posterior teeth, and had been chewing on the anterior teeth. In other cases, ill-fitting and unsuccessful partial dentures had necessitated anterior functioning. In those cases with a protrusive and lateral eccentric functional point, it was found that the patient had anterior teeth with one or more posterior teeth on one side.

Some patients were wearing dentures that had originally been constructed in a protrusive relation, and, through their tactile sense, this position of function, which was eccentric, had developed.

Apparently, these patients had stimulated the muscle tissue in the acquired position to develop a more than normal strength in the eccentric position rather than in the normal centric position.

The same patients, given the opportunity for function in normal centric as well as eccentric position, together with a more nearly normal vertical position, seemed to improve the biting force. Cases that had lateral and protrusive functional areas seemed to correct themselves toward the normal centric position. The first movement of correction was from the lateral to a directly protrusive area.

Some cases returned in a matter of a few weeks to normal centric position, while others had not returned in a period of two years, although there had been an improvement in the case with a degree of return from an extreme eccentric position toward a normal centric position.

Various types of treatment, as well as the various types of patient, seemed to have an effect on the time that it took for the case to return to a normal centric position. However, they did indicate that the normal centric relation anatomically is the position of the greatest biting force as well as of true function in most cases.

The cases that exhibited a marked retrusion of the mandible in centric relation and the protrusive functional area did not seem to correct themselves to normal centric relation, but seemed to function about half-way between centric position and the power points.

These eccentric functions can be noted in various technics if the operator will recognize three steps in registering intermaxillary relation: vertical, centric and functional relation.

In using any type of tracer or needle arm, the operator can ask the patient to continue a champing or chewing position, and follow this by the gothic arch tracing. In this way, he can visualize whether the case is functioning near the apex of the gothic arch.

In the use of biteblocks, the operator, after determining the vertical dimension, can secure the most retruded position of the mandible. Then by placing two lines or grooves on each side, he can free the biteblock and ask the patient to champ or open and close the jaws a number of times in what he believes is a comfortable biting position. If the lines or grooves that are made in the most retruded position are in line when the case is in the functioning position, the operator can consider function normal. However, if the functional position is eccentric and the lines or grooves are not in line, he then has the problem of eccentric function as well as the normal centric position.

With the use of the gnathodynamometer, the operator can definitely determine by a bite recording whether the patient is capable of registering a greater biting force in functional position, which may be eccentric, than in the normal centric position.

There are apparently four methods of treating these cases that exhibit eccentric function. The first is the construction of dentures in the eccentric position. It is my belief that a high percentage of dentures are built with functional relation as centric occlusion because of the technic used.

The second method is to provide centric occlusion at the normal centric relation regardless of where function has been acquired. This might be termed the tactile treatment; that is, the patient, through his feeling of the cusp relation, returns to the normal centric position. In any of these treatments, the percentage of success and failure depends on the patient's ability to adapt himself to the conditions presented in the denture restoration.

The third method might be considered the exercising treatment. The operator recognizes an eccentric position, but sets the case in normal centric occlusion, which is normal centric relation, and prescribes a series of exercises for the patient to bring the mandible into normal centric relation for normal function. This treatment would seem to be an improvement over the tactile method. However, its success would depend more or less on the ability of the patient to follow out the prescribed exercising technic as well as on his mental adaptation to a process of exercise.

A fourth method is an accommodation of the occlusion to both normal centric relation and eccentric function relation. This requires a recording of normal centric relation as well as the area of eccentric function. The mandible is always set at the normal centric relation or near the apex of the gothic arch. This position is used because it is recognized as the correct anatomic intermaxillary relation and the probable position of most efficient function. The occlusion is then balanced to eccentric position. If this requires a movement of 1, 3, 5 or 7 mm., the occlusion is balanced to that area.

A cuspless tooth is always used in the treatment of these cases because, apparently, a mechanical type tooth is the only type that will provide a return of the direction of the force of occlusion to the ridges in two separated horizontal locations of the mandible. With a cusp tooth, the returned direction of force from the occlusion is directed at an angle determined by the degree of cusp inclination as soon as the occlusion has left centric relation and the patient is not directing the force back toward centric position, established by cusp occlusion. In the cuspless occlusion, the dentures can function in either eccentric or centric position, or any position between the two points, and the force of occlusion be directed back to the ridge.

Apparently, given the opportunity, the mandible wishes to correct its position and will return to the normal position over a period of time. In some of these cases of free occlusion, the case has returned to normal centric position within six weeks; in some cases, six months; in others, a year; while some cases have only returned part way toward normal centric position over the period of a year. Cases of the extremely retruded mandibular position may not return because of the patient's desire for function in a position which has the lower ridge area more directly under the maxillary ridges.

It can be assumed that a cusp tooth, under normal conditions, provides a better masticating surface. However, if there is no function, there can be no efficient mastication. The cuspless tooth could be considered as a treatment tooth in these cases of eccentric function. In

ideal cases, they could be used until the case had assumed normal function, and then it could be reconstructed with a cusp tooth.

Cases constructed in eccentric function cannot return to a retruded normal centric position because the second molars will strike first in occlusion.

Cases employing a chewing-in technic may balance in most positions, but the eccentric position may be provided as centric occlusion and an easy path to the normal centric position would be lacking. Cases using cusp teeth could function only if the tactile sense or exercising ability were of such a degree as to permit the teeth to return to normal centric occlusion or relation for function.

An important consideration in the success of tooth arrangement is the setting of the horizontal overbite or overjet according to the distance of the eccentric functional area from the normal centric relation.

If the eccentric position is 3 mm. from the normal centric position, approximately 3 mm. of horizontal overbite is indicated. If the distance from eccentric relation to normal centric is 5 mm., approximately a 5 mm. overbite is indicated. The horizontal overbite is closely related to the ridge relation. However, the relation of eccentric function to normal centric relation is a very important factor in the degree of horizontal overbite.

The cuspless tooth is a great aid in setting the teeth to occlusion with various degrees of horizontal overbite, since it may be possible to leave out a tooth or change the tooth relationship somewhat, this depending on the amount of horizontal overbite determined for the case.

When this technic is carried out in the mouth, the patient apparently does not have any horizontal overbite. In talking and in function, there will be very little horizontal overbite. In some cases, the set-up on the articulator might seem to be quite extreme, but, in the mouth, the appearance as well as the function is apparently normal.

It was interesting to note that most cases of extremely retruded mandible relations in normal centric position required an extreme horizontal overbite. This provided a close relation between function and appearance.

By determining the fundamentals involved, a technic can be developed that will include the factors in and provide a means for more successful denture restorations.

SUMMARY

1. The intermaxillary relation can be divided into three fundamentals: vertical dimension, centric relation and functional relation.

2. Approximately 32 per cent of the functional relations of the mandible to the maxillae are eccentric or function is not near the normal centric relation.

3. Provided the operator recognizes the fundamental relations of the intermaxillary position, the case can be treated according to the classifications or desires of the operator.

4. A suggested technic calls for the use of cuspless teeth and securing a balance from normal centric relation to eccentric function. The horizontal overbite is varied in relation to the distance from normal centric relation to eccentric functional relation.

808 Nicollet Avenue.

CHEMICOTHERAPY AND PHYSIOTHERAPY AS ADJUNCTS IN CONSERVATIVE TREATMENT OF PERIODONTAL DISEASE

By J. Lewis Blass,* Ph.G., D.D.S., New York, N. Y.

It is generally recognized that the therapy of periodontal disease is primarily mechanical and that its etiology, complex as it may be, is, in a great majority of cases, primarily dysfunctional and irritational.[1]

It follows, then, that restoration of normal periodontal function by such means as occlusal shaping and equilibration, removal of supragingival and subgingival calculus, smoothing and polishing of enamel and cementum, increase of gingival circulation and elimination of periodontal pockets is the ultimate objective in the treatment of periodontal disease.

In considering the question of the therapeutics of periodontal disease, it should be emphasized that treatment with drugs is only an adjunct. It might be well to point out here that, although therapeutics is generally regarded as the treatment of disease by drugs, it has a broader meaning, covering the use of all agencies or treatment in the prevention, relief or cure of disease. Thus, these may partake of operative, reparative, hygienic or preventive measures as well as drug administration.

It is with this thought, namely that drugs are only one means in therapeutics, that the following paper is presented, relating to chemicotherapy and physiotherapy in conservative treatment of periodontal disease The presentation will be made with special reference to the rationale, uses, application and limitations of the therapeutic agents mentioned.

*Assistant Professor of Periodontia, New York University, College of Dentistry.

†Except when otherwise indicated the prescriptions and formulae are the author's.

PRESCRIPTIONS†

Anesthetics.—The formula for a topical anesthetic is as follows:

℞	Benzocaine	7.5
	Oil of peppermint	6.0
	Phenol crystals	3.5
	Ethylene glycol q.s.	50.0

Mix the benzocaine, oil of peppermint and phenol crystals in a flask and heat until the solution of the benzocaine is effected. Add enough ethylene glycol to make 50 cc.

Rationale: Benzocaine depresses the sensory nerve endings when in contact with them in sufficient concentration. The phenol and oil of peppermint aid in the solution of the benzocaine and enhance the penetration and the anesthetic action of the benzocaine. The practical limitations to the effectiveness of topical anesthesia of the gingivae and oral mucous membrane is thus summarized by Tainter and Moose[2]:

> It can be said that the topical anesthetics in current use do not penetrate deeply enough to ensure adequate anesthesia in a sufficient number of cases to be considered satisfactory. They are of some value in hypersensitive patients. The agent or solution has not yet been introduced that will produce adequate anesthesia at sufficient tissue depth with reasonable rapidity and without tissue irritation and toxicity. These properties are the prerequisites of an ideal topical anesthetic, but such an agent remains to be discovered.

The foregoing formula yields a 15 per cent solution of benzocaine in a non-

irritating, fluid vehicle that makes contact with the membranes in the presence of saliva. Its use in the manner suggested induces a satisfactory degree of anesthesia for an adequate length of time.

Uses and Application: In subgingival curettage, a small amount of the solution is applied in the gingival sulci or periodontal pockets from the beaks of college pliers. In gingival pain from toothbrush or other abrasion or following extensive instrumentation, the solution is applied with a cotton pledget and the patient is instructed to repeat the application every three or four hours.

Deodorants.—Chloramine powder may be used as an oral deodorant.

Rationale: According to Haggard and Greenberg,[3]

> Chloramine is a true deodorant. A solution in water, one per cent, is useful in overcoming mouth odors of local origin. It should be borne in mind that the symptoms and not the cause of the underlying condition are thus being treated.

The probable mechanism of chloramine action is oxidation by chlorine.

Aromatic chlorazene powder, a chloramine compound with a pleasant taste and odor, may be substituted for the foregoing.

Uses and Application: The foregoing solutions are used by dissolving one-third teaspoonful of the powder in one-half glassful of warm water every three or four hours. The solution is made fresh for use each time. The solutions are best used as a mouth rinse and toothbrush dip after meals.

Care in Application: In the treatment of mouth odors, it must be remembered that the cause may be other than from the mouth; that is, from dental decay, tongue coating, simple gingivitis, periodontal pockets or necrotic gingivitis. The source may be nose, throat or lung disease; malodorous substances from foods or from abnormal kidney, bowel or skin products eliminated through the lungs, or, more commonly, stomach and intestinal disorders. Prolonged use of deodorant should not be permitted. The patient should be referred to a physician for diagnosis and treatment.

Abrasives as Polishing Agents.—A pumice-bentonite abrasive paste is made as follows:

℞	Saccharin-soluble	0.25
	Bentonite, powder	13.00
	Oil of cinnamon	0.25
	Oil of peppermint	1.50
	Calcium carbonate U.S.P.	20.00
	Sol. amaranth 10%	1.00
	Pumice flour	64.00

Mix, make a powder and place in capsules No. 000.

Rationale: Pumice is used by the dentist for cleaning and polishing the teeth, the flour being fine enough to insure freedom from scratching cementum. The addition of bentonite makes a colloidal suspension of the preparation when mixed with water. Calcium carbonate aids in polishing. The other ingredients flavor and color the preparation.

Uses and Application: To make a paste of ideal consistency, the powder is emptied into a dappan dish and as much water is added as can be held by the cap of the capsule. The paste is applied with a porte-polisher or rubber polishing cup.

Caustics as Desensitizers for Dentin and Cementum.—The following may be used:

Solution of formaldehyde 40%
Paraformaldehyde powder
Silver nitrate solution 50%

Rationale: Solution of formaldehyde and paraformaldehyde powder act by precipitation of protein. Silver nitrate solution forms a precipitate with protein and forms a mixture of silver proteinates and reduced silver. It is believed that the precipitates formed prevent pain impulses from being carried to the pulp.

Uses and Application: In cervical, oc-

clusal and incisal sensitiveness, solution of formaldehyde or paraformaldehyde powder is applied with a small rubber polishing cup. A small drop of the liquid or powder is placed in the cup held in the engine handpiece. The cup is held against the tooth surface and the engine run at full speed. When a sensation of heat is reported by the patient, the application is stopped, the tooth is allowed to cool and the area is washed free of the drug.

In approximal sensitiveness due to advanced alveoloclasia and gingival recession, the silver nitrate solution is applied with a cotton pledget, left in place approximally for a short time, and is followed by a eugenol and zinc oxide pack, which is allowed to remain for three or four days. The eugenol in the pack reduces the silver nitrate while the pack keeps the area free of food and other detritus until interproximal sanitation can be carried out painlessly.

Care in Application: Solution of formaldehyde and paraformaldehyde powder are highly irritating to the gingivae and mucous membrane and their use may cause the usual symptoms of irritation, such as reddening, inflammation and necrosis. Silver nitrate is also caustic and an irritant to the soft tissues. If application to cementum or dentin is intended, the soft tissues should be protected by the use of cotton rolls.

Topical Antidote: After accidental application of solution of formaldehyde or paraformaldehyde powder to soft tissues, ammonia water or aromatic spirits of ammonia should be applied and the area should be rinsed with water. In the case of silver nitrate, a solution of table salt, 1 teaspoonful to a glassful of water, is used as a mouthwash.

Dentifrices.—A salt and lime dentifrice (modified Prinz) is as follows:

℞ Menthol
Saccharin aa 0.6
Calcium oxide 12.0
Methyl salicylate 2.0
Sodium chloride fine 500.0

Mix: Make a powder and dispense in glass.

Sig: One-third teaspoonful in a glassful of water as a mouthwash-dentifrice.

Rationale: This compound yields a sweetened and pleasantly flavored salt and lime water solution. The lime water is antacid and mildly astringent and the saline solution cleanses the mucous membranes without irritation.

Uses and Application: The solution is used for massage brushing and as a mouthwash for sensitive mucous membranes.

Topical Antidote: The use of this dentifrice in too high a concentration or as a powder may irritate the mucous membrane. The method of dilution should be a safe one. To relieve the effects of irritation from calcium oxide, the use of a mild acid mouthwash, made by mixing one teaspoonful of hydrogen peroxide in a half glassful of water, is advised.

A sodium oleate dentifrice (modified N. F.) is as follows:

℞ Sodium oleate 6.0
Saccharin 0.2
Oil of clove..... 1.0
Oil of cassia 0.5
Oil of peppermint..... 0.5
Alcohol 50.0
Glycerin 25.0
Water q.s. 100.0

Sig: Use 10 drops full strength on a dry brush as a dentifrice.

Rationale: This soapy dentifrice, which has a tendency to lubricate the toothbrush bristles, is a detergent.

Uses and Application: This dentifrice is of use in toothbrush abrasion of the hard or soft structures. Patients who brush vigorously frequently show signs of toothbrush abrasion. Box[4] advises the use of sodium oleate in a dentifrice "where special protection of the tooth surface against acid attack is indicated, as, for example, in enamel surface defects such as chemico-abrasion, and in extreme

cases of susceptibility to dental caries." He ascribes the following properties to the solution:

> This solution is detergent and is absorbed on the tooth surface as a film of sodium oleate. This apparently undergoes dissociation in the human saliva, leaving on the tooth an extremely thin coating of oleic acid.

Epithelial Solvent.—A formula (McCall) for such a solvent is as follows:

℞ Sodium sulfide .....70 grains
Sodium carbonate, $1H_2O$. 20 grains
Water q.s. ..... 1 ounce
Mix. Make a solution.

Rationale: While the conservative treatment is adequate for pocket healing, this epithelial solvent is useful when epithelium is present on the soft tissue side of the pocket. According to McCall,[5] the foregoing solution dissolves the epithelium to permit its complete removal by curets and stimulates connective tissue growth necessary for reattachment. glassful of water.

Uses and Application: Cases chosen for treatment with an epithelial solvent should first be given the usual course of routine conservative periodontal treatment. The solution is applied on a twist of cotton or bibulous paper and carried into the pocket with a smooth broach or with a No. 17 explorer the point of which has been broken off. The mouth is rinsed and, after three minutes, the solution is withdrawn and a second application made and continued for seven minutes. After withdrawal of the second application, a curet is used to remove the disintegrated epithelium and to further cleanse and smooth the root surfaces. The tissue is pressed lightly to contact the tooth root and held so for five minutes to allow clotting. The patient is warned to avoid brushing or other trauma to the treated area for three or four days. Traumatic occlusion is relieved before the patient is dismissed. The treatment is repeated in from seven to ten days if the pocket has not closed.

Care in Application: The solution is caustic to soft tissues when held in contact with them for a great length of time. To prevent caustic action, no cotton rolls are used, but the area and the entire mouth are washed or sprayed well after the solution is applied.

Gingival and Protective Seal.—A periodontal varnish formula is as follows:

℞ Gum copal 16.0
Gum mastic 16.0
Tr. myrrh 20.0
Ether 20.0
Collodion 40.0
Mix. Make a solution and dispense in 8 cc. homeopathic vials.
Sig: Apply to dried tissue and tooth.

Rationale: The gums, resins and collodion in this compound are precipitated by water and form a sticky seal, which adheres to the dried tooth, gingiva and blood clot, protecting the operative area and holding the soft tissue side of the pocket in close apposition with the tooth root. The action of the varnish is a mechanically protective one.

Uses and Application: After subgingival curettage, with or without the use of a sodium sulfide epithelial solvent, the area is isolated with cotton rolls, the tooth and adjacent gingiva are dried and the varnish is applied with a cotton swab. The area is allowed to dry for one minute and a cotton swab soaked in water is applied. The precipitate is patted to place with the wet swab. The varnish seal usually stays in place at least twenty-four hours, long enough to allow primary organization of the clot.

Astringents.—The formula for an astringent is as follows:

℞ Tannic acid 30.0
Glycerin 30.0
Place the drugs in a bottle and heat on a water bath until the tannic acid is dissolved.
Sig: Tannic acid solution, 50% in glycerin.

Rationale: Tannic acid is an astringent acting through its ability to precipitate proteins. Its mixture with glycerin, the vehicle, aids by withdrawal of water

from tissue cells. By this means, tissue shrinkage is accomplished.

Uses and Application: In localized or generalized hypertrophy accompanied by edema, the solution is applied under the tissue flap on a rope of lens paper. It is allowed to remain for ten minutes and is followed with a mouthwash of hypertonic salt solution, used every two hours for three or four days. The latter, as recommended by Box, is made by dissolving 2½ teaspoonfuls of salt in a glassful of water. One application of tannic acid solution is usually sufficient. If necessary, a second application may be made in one week.

Mouthwashes for Necrotic Gingivitis.—Hydrogen peroxide is often used for this purpose.

Rationale: Hydrogen peroxide solution is decomposed on contact with cellular material, to liberate oxygen. The latter acts to destroy organisms commonly found in the oral cavity and is especially effective against the symbiotic organisms considered important in the etiology of necrotic gingivitis.

Whether or not an antiseptic, bacteriostat or spirocheticide is used in the treatment of necrotic gingivitis, the constant home use of a mouthwash capable of liberating oxygen is generally considered essential.

Uses and Application: For greater effectiveness, the solution should be prepared fresh for use. The patient mixes one teaspoonful of hydrogen peroxide solution in a half glassful of water, for use as a mouthwash every hour or less frequently as required.

Care in Application: The use of hydrogen peroxide solution is to be limited to the active stage of the necrotic gingivitis and the patient must be warned that the solution, if used steadily, may become a source of tongue and mucous membrane irritation.

The use of sodium perborate, long a favorite in the home treatment of necrotic gingivitis, has proved a frequent source of soft tissue irritation. Miller et al.[5] compared the oral irritant action of hydrogen peroxide and sodium perborate and found tongue changes (hypertrophy of the filiform papillae) in 6.8 per cent of those using hydrogen peroxide and 21.1 per cent of those using sodium perborate. They concluded:

> The possible causation of oral pathosis by the use of these substances indicates the need for their use only under supervision as specific therapeutic agents, with definite instructions to the patient as to concentration to be used, frequency and method of use, and the need for rinsing the mouth with water after the solutions touch the oral tissues. Systemic effects are possible from the excessive use of sodium perborate.

Topical Antidote: If signs of inflammation result from the use of hydrogen peroxide solution, the patient should discontinue the use of the solution and wash with a solution made by dissolving one teaspoonful of sodium bicarbonate in a glassful of water.

Zinc peroxide powder is also used as a mouthwash for necrotic gingivitis.

Rationale: Wintrup[6] showed this substance to be an oxidizing deodorant which, unlike hydrogen peroxide and sodium perborate, continues to react "almost as long as it is possible to retain it in contact with the tissues of the mouth." Zinc peroxide has more available oxygen content than either of the other drugs and its pH (8.8) is more favorable than the marked alkalinity (10.2 to 10.5) of sodium perborate or the marked acidity (1.2 to 2.0) of hydrogen peroxide. The latter, when diluted in the amount of 1 teaspoonful to a half glassful of water, has a more favorable pH, approximately 5.0.

Uses and Application: Zinc peroxide is applied to the gums as a paste mixed with distilled water and the patient is directed to repeat the application at home at half hour intervals for twenty-four hours. The frequency of application is decreased as the infection is brought under control.

Care in Application: As with hydrogen peroxide, the use of zinc peroxide is to be limited to the active stage of the necrotic gingivitis and the patient must be warned of this fact.

Physiotherapy.—A hot water irrigator may be used in physiotherapy.

Rationale: Local heat treatment increases local blood and lymph circulation and local tissue metabolism. It promotes resorption of products of inflammation, permits restoration to normal function and relieves pain. This effect is brought about by dilatation of the blood vessels, thereby promoting better peripheral blood flow and causing a more rapid exchange of metabolic products between the blood and cells. The hot water irrigator offers an excellent means of assuring these desirable effects.

However, a review of the literature on the effects of heat and cold application by Spangenberg[7] led to the conclusion that the relief of pain seems to be the only reason for the use of thermal agents.

Uses and Application: This treatment is used in any stage of necrotic gingivitis, catarrhal stomatitis, parodontal abscess and acute gingival and oral infections. The last named are treated symptomatically. In these cases, attention is also directed toward the elimination of the temperature rise and the anorexia by administering a saline laxative or cathartic. This may be 1 tablespoonful of magnesium sulfate (Epsom salt) or one teaspoonful of sodium and potassium tartrate (Rochelle salt), dissolved in a glassful of water, preferably administered on an empty stomach in the morning. The action of the saline cathartics under these conditions normally takes place within from two to four hours. A bland, non-irritating diet rich in diluted fruit juices, cooked vegetables and milk is prescribed, as in necrotic gingivitis. The non-specific micro-organisms, destroyed soft tissue and food débris are removed by hot water irrigation used every three to four hours, or as often as every half-hour if the severity of the infection demands it.

The greatest and most rapid improvement is made when the patient is taught the use of water sufficiently hot, and if he employs the method properly at home. For this purpose, a fountain syringe hung 2 feet above the level of the head as it is inclined over a wash basin is employed. A glass medicine dropper is placed at the end of the tubing. Two quarts of water, as warm as can be tolerated by the patient (usually 115° F.) is placed in the container, and 1 tablespoonful of salt and, if desired, an equal amount of sodium bicarbonate are dissolved therein. The solution is then allowed to flow into all parts of the mouth.

To protect the patient from burns and, on the other hand, to insure the application of a sufficiently high degree of heat, it is advisable to demonstrate the procedure in the office. This is done by the use of a fountain syringe that has a Becton-Dickinson infusion thermometer inserted as a connecting tube between two parts of the rubber tubing attached to the syringe. The temperature of the water, as indicated by the thermometer, can be tested so that, by the addition of either hot or cold water, the desired temperature of 115° F. is reached.

Rinsing alone is valueless, since water from a drinking glass touching the lips cannot be used so hot as can be tolerated by the mucosa.

In this paper were presented only those agents that are of practical use in everyday practice and that have proved their value through the test of time. In addition, an attempt was made to indicate the use of drugs rationally rather than empirically. *It must again be emphasized that none of these agents is indispensable, and that they act only as adjuncts in modern and successful periodontal treatment.*

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475 Fifth Avenue.

PERIODONTOCLASIA IN DIABETES MELLITUS

By STANLEY A. LOVESTEDT, D.D.S., and LOUIE T. AUSTIN, D.D.S.,
Rochester, Minn.

IN an attempt to determine the percentage of periodontoclasia among diabetic patients, a study was made of the history and clinical and roentgenographic findings referable to the oral cavity in a series of cases of diabetes.

Feinblatt[1] pointed out that older diabetic patients present considerable evidence of degenerative dental changes, but he did not attribute the changes to diabetes as such. In many instances, the clinical findings were due rather to local conditions. Schour[2] described changes in the gum tissue following removal of the pancreas, the lowered resistance to oral infection of diabetic patients and the predisposition to periodontoclasia. Diabetic patients may be hypersusceptible to many conditions. Badanes[3] stated, however, that diabetes need not necessarily be associated with, or accompanied by, gingivitis or periodontoclasia.

From the Section on Dental Surgery, Mayo Clinic.

SERIES STUDIED

The 503 diabetic patients whose records form the basis of this study were seen at the Mayo Clinic in the Section on Metabolism Therapy and the Section on Dental Surgery during a period of fifteen months. The control group consisted of 1,023 consecutive patients seen by one of us (S.A.L.) in the section on Dental Surgery during three of the fifteen months. Diabetic patients, however, were excluded from the control group.

In the diabetic group of 316 males and 187 females, the ages ranged from 11 to 77 years. The ratio of males to females is approximately the same as that for the general incidence of diabetes mellitus. Our control series consisted of 518 males and 505 females and the ages ranged from 5 to 85 years. We recognize that this study does not offer a true cross-section of either diabetic or non-diabetic patients (Table 1). Table 2 has been prepared, with the age of 40 years as the median, to show the percentage of dis-

tribution of our series in the two age groups.

SYSTEM OF GRADING

The severity of periodontoclasia was graded on a basis of 0 to 4. Grade 1 means that slight gingivitis was present, with possible isolated regions of bony involvement; Grade 2, that bony involvement was present, but extraction of not more than three teeth was indicated, and Grade 3, that there was considerable bony involvement, but still some hope of benefit from treatment; extraction of more than three teeth, but less than all, was indicated. Grade 4 means involvement to the extent that extraction of all the teeth was indicated. Grade 0 indicates that the mouth was in splendid condition or the patient was edentulous.

The severity of the diabetes was graded from 1 to 4. Grade 1 indicates that the diabetes was mild and could be controlled qualitatively by diet alone. Grade 2 was controlled by quantitative diets without insulin. Grade 3 required insulin, for control, but less than 30 units per day. Grade 4 required more than 30 units of insulin per day for control.

TABLE 1.—AGE AND SEX DISTRIBUTION IN SERIES STUDIED

Age Years	Cases	Diabetes		Control Series	
		Males	Females	Males	Females
0-9	4	1	2	1	—
10-19	28	4	6	5	13
20-29	174	13	10	59	92
30-39	309	31	22	137	119
40-49	411	81	51	144	135
50-59	399	109	63	122	105
60-69	180	67	33	42	38
70-79	17	10	—	4	3
80	4	—	—	4	—
Total	1,526	316	187	518	505

TABLE 2.—DISTRIBUTION INTO TWO AGE GROUPS

Age Group Years	Sex	Diabetes		Control Series	
		No.	Per Cent	No.	Per Cent
0-39	Males	130		202	
	Females	91		224	
	Total	221	43.9	426	41.6
40-88	Males	186		316	
	Females	96		281	
	Total	282	56.1	597	58.4

TABLE 3.—DISTRIBUTION ACCORDING TO GRADE OF PERIODONTOCLASIA

Periodontoclasia	Diabetes		Control Series	
	No.	Per Cent	No.	Per Cent
Grade 0	97	19.3	122	11.9
Grade 1	163	32.4	732	71.6
Grade 2	158	31.4	151	14.7
Grade 3	61	12.1	14	1.4
Grade 4	24	4.8	4	0.4
Total	503	100.0	1,023	100.0

TABLE 4.—EDENTULOUS PATIENTS

Degree of Absence of Teeth	Diabetes		Control Series	
	Males	Females	Males	Females
Totally edentulous	23 (7.3%)	18 (9.6%)	22 (4.2%)	27 (5.3%)
Edentulous maxillary arches	20 (6.3%)	27 (14.4%)	23 (4.4%)	24 (4.8%)
Edentulous mandibular arches	2 (0.6%)	2 (1.1%)	1 (0.2%)	—
Total patients	316	187	518	505

OBSERVATIONS

That a higher percentage of diabetic patients than controls had periodontoclasia of Grades 2, 3 and 4 (Table 3) is one of the most important findings of our study.

Dental roentgenograms of diabetic patients did not reveal anything on which a diagnosis of diabetes could be made. Patients with diabetes Grade 4 may be seen in the dental office, and the dentist, even though aided by a complete set of roentgenograms, may be unaware that

the patient is a diabetic. The roentgenograms of completely edentulous mouths of diabetic and control patients varied little. An increase in radiolucency might possibly be read into roentgenograms of a known diabetic patient, but diabetic patients who were totally edentulous at an early age did not present a later loss of alveolar process sufficient to classify the loss as caused by diabetes mellitus.

Clinical findings in diabetic cases failed to differ essentially from the findings in the control cases. In fact, patients with long standing and controlled diabetes are invariably free from dental infection; this, if it ever existed, having been eliminated previously in an effort to be rid of all potential foci of infection.

An effort was made to correlate findings in the general histories of diabetic patients that might give a dental index. This proved impractical owing to the lack of consistent recording of relevant facts. True, some patients gave a history of dry mouth, dry skin, thirst, burning tongue, etc., but such general observations do not lend themselves to statistical tabulation.

Brekhus[4] stated that 26 per cent of the men in his study had edentulous maxillary arches at the age of 40, and 13 per cent edentulous mandibular arches. Of the women, 43 per cent had edentulous maxillary arches and 21 per cent edentulous mandibular arches at the same age. For comparison of our series with these figures, we have used totals that include patients less than 40 years of age as well as those who were more than 40 years of age. We have included, also, a listing of the patients who are totally edentulous. We found that diabetic patients were more frequently edentulous than the controls (Table 4).

COMMENT

When the many usually given factors in periodontoclasia are considered, it is readily understood why we are reticent in saying that diabetes mellitus causes periodontoclasia. Periodontoclasia may be more severe in some cases for the same reason that diabetes is sometimes complicated by advanced periodontoclasia. Von Muller[5] observed that periodontoclasia often occurs with systemic disturbances and is not the cause of them. We have, in our study, seen the necessity of regular dental care as well as diabetic care. When diabetes is known, it should be a routine consideration to check the mouth as well as the visual fields. A program of rigid oral health must be maintained. The usual occurrence of diabetes in the later years of life gives every dentist a chance to initiate a dental program that will protect the patient from oral infection if diabetes develops later.

SUMMARY

In our study, the incidence of periodontoclasia, Grades 2, 3 and 4 was found to be greater among diabetic patients than among control patients.

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A COORDINATE SYSTEM FOR SPECIFICATIONS OF ARTIFICIAL TEETH

By M. Russell Stein, D.D.S., New York, N. Y.

IN the past decade, the volume of dental service rendered by institutional clinics and governmental dental departments has been constantly increasing. The prosthetic sections of these agencies use large quantities of artificial teeth. The United States Government is by far the largest and most important consumer.

Artificial teeth are purchased from several manufacturing companies. Each company has its own method of classifying sizes, forms and colors. The basic differences between the methods are so great that it is virtually impossible to combine them in a single comprehensive system. Systems of artificial teeth are encumbered by many trade names, trade numbers and haphazard size and color arrangements, in creation of which sales promotion was the dominating motive. Government specifications, today, conform to these commercial systems.

By virtue of the importance of their present and future rôle in dentistry, government agencies, rather than to conform to the manufacturers' specifications, should draw basic specifications for artificial teeth and require the manufacturers to conform to these official specifications.

Far-reaching benefits could be derived from a systematization and standardization of variable factors of artificial teeth: (1) economy in future purchases; (2) reduction in inventories; (3) facility in selection, and (4) reduction in time and labor in handling the stock.

From the Department of Anthropology, Columbia University.

VARIABILITY IN TEETH

Variability is the keynote in nature. Upper central incisors, for example, vary from one individual to another. Like faces and fingerprints, there are no two alike. They follow the laws of heredity, as do other living organs, and manifest variations, mutations and dominant and recessive traits. Despite this variability, any central incisor could readily be differentiated from a group of molars or bicuspids because there are basic ways in which incisors resemble each other. These are called anatomic constants. The ways in which they differ from each other are called anatomic variants. Classifications, by purpose and function, must be based upon variations. In teeth, the variable features are numerous, far too numerous to be all included in a practical system. Therefore, a fundamental classification should use only those variable features which have proved to be of prime importance in prosthetic practice: size, form and color. Any classification of artificial teeth should designate a particular tooth by a connotation that indicates its exact position in each of three scales of variation.

Size.—On account of its importance in selecting artificial teeth, the central incisor is used as a starting point in all systems.

Central incisors differ in absolute size; that is, in actual mass. Central incisors also differ in length-breadth ratio, or proportion of width to length. This ratio is referred to as the coronal index, an expression of distribution of mass or size, but having no bearing on absolute size.

$$\frac{\text{Breadth}}{\text{Length}} \times 100 = \text{coronal index.}$$

Example: If a central incisor measures 7.2 mm. mesiodistally and 9.6 mm. cervico-incisally, its index would be 75.

$$\frac{7.2}{9.6} \times 100 = 75.$$

In other words, the width is 75 per cent of the length. A central incisor may have a coronal index of 75, whether it is large or small.

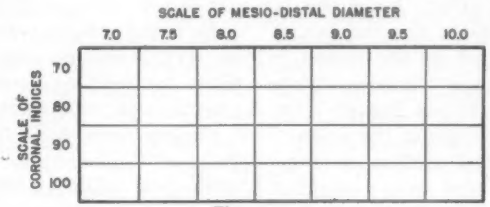

Figure 1.

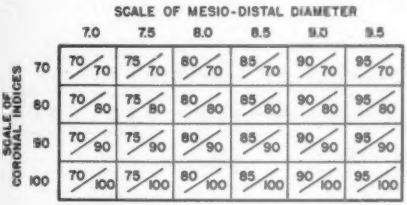

Figure 2.

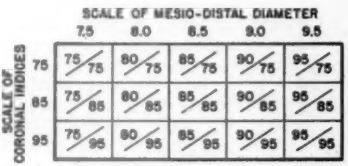

Figure 3.

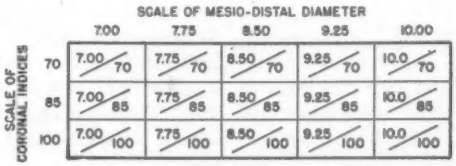

Figure 4.

A low coronal index indicates a long narrow crown, whereas a high coronal index indicates a short squatty crown.

In practical dentistry, the width of a central incisor is more important than the length.

A size classification should therefore start with a scale of widths as its first variable co-ordinate. The range of variation is from 7 to 10 mm. The customary increment in systems of artificial teeth has been 5 mm.: 7.0, 7.5, 8.0, 8.5, 9.0, 9.5, 10.0 mm.

For each width, there is a range of lengths. In order to establish homogenous correlated groups, the lengths should be graded according to the width. In other words, the second variable of the coordinate should be a scale of coronal indices. The natural range of coronal indices is from 70 to 100. (Fig. 1.)

Thus, there would be seven widths, and four lengths for each width, a total of twenty-eight sizes. Each size could be designated by its position in the coordinate scale. (Fig. 2.) 85/90 indicates a central incisor with a mesiodistal diameter of 8.5 mm., which is 90 per cent of the crown length.

This scale of twenty-eight sizes includes within its extreme ends very small and very large teeth, which occur much less frequently than the middle groups.

It also includes central incisors that are very long and thin and those that are as wide as they are long.

For practical purposes, the number of groups can be reduced by eliminating the extremes, without materially altering the efficiency of the system.

The system depicted in Figure 3 contains fifteen sizes and would cover more than 98 per cent of all practical prosthetic requirements.

The number of groups could also be reduced by enlarging the increments. This is demonstrated by the system in Figure 4, which also contains fifteen sizes, but, unlike that of Figure 2, includes the extreme ends of the scales.

The most practical method of reducing the number of size groups would be to change the customary increment from

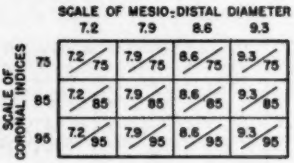

Figure 5.

0.5 to 0.7 mm. and to drop the extreme limits of the scales. (Fig. 5.)

The twelve sizes of this system would cover all prosthetic requirements more efficiently than the old type haphazard arrangements of double and triple its size. The simplicity and reduction of inventories made possible by such a system is self-evident.

From a statistical survey of the sizes of anterior teeth of the American population, an average proportion of sizes of central incisors, lateral incisors and cuspids could be determined. Thus, for each size of central incisor, there would be a statistical normal set of six anterior teeth. This statistical norm would not depict or imply a normal set of sizes in nature because of the different individual variability curves of central incisors, lateral incisors and cuspids. The wide variability of lateral incisors would diminish the probability of occurrence of the statistical norm of the combination set in nature. However, if the dental profession is to continue to handle anterior teeth in sets of sixes, it would do well to designate the size of a lateral incisor or cuspid by the size of the central incisor with which it is associated in the statistical norm. Then the designation of the size of the central incisor would hold for a set of six anterior teeth.

Form.—Forms of central incisors vary in: (1) peripheral outline; (2) mesiodistal contour; (3) cervico-incisal contour, and (4) surface markings.

Outline forms have been classified by J. Leon Williams into square, tapering and ovoid. Although this is an arbitrary classification, with no relation to natural divisions, it has been useful in merchan-

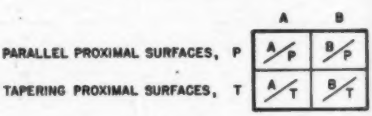

Figure 6.

dising teeth. The three classes are unnecessary from a practical standpoint because teeth that are really square or ovoid as described by Dr. Williams have had little use in prosthesis. Ovoid teeth, in particular, are limited in use because they create exaggerated interproximal spaces and the much overrated marble contacts. Two groups of peripheral outlines adequately cover the requirements: P, parallel proximal margins, and T, tapered proximal margins. These would constitute one scale on a coordinate system.

Any classification of tooth forms based on peripheral outline alone ignores the other variable factors, which are far more important from a prosthetic standpoint. Peripheral outlines can readily be altered in a setup by manipulation of the base material. Any given tooth can be made to appear square, tapered

or ovoid by flowing of wax around the cervical margin of the crown.

The mesiodistal contour and cervicoincisal contour could be combined to form the second scale of the coordinate system of forms. They could be designated by the dominant topographic characteristics of the combined contours: A, dominantly convex, and B, dominantly flat and concave. The resulting system is illustrated in Figure 6. There are four groups of forms.

An additional scale for surface markings would be inexpedient. The resulting increase in the number of molds would not be warranted by the benefits gained. Surface markings could be used in the form and size groups with which they are customarily associated in nature.

Color.—Every manufacturer has his own conception of the range of color in human teeth. They are all different, no two having a common basis for classification. The confusion in color is confounded by an air of mystery and the situation is by no means helped by the wide difference in physiologic perception of color in different individuals.

Colors cease to be mysterious when they are analyzed from the standpoint of their variable properties. Every color has three variables: hue, saturation and brilliance.

Hue is the primary color content, yellow, red or blue, or combinations thereof. Saturation is the quantity of that color. Brilliance is the amount of grayness in the color. The brilliance value is independent of color itself.

In reproducing natural teeth, it is necessary to reproduce not only the hue, or color value, but also the correct brilliance. Attention heretofore has been focused on hue. Brilliance has been ignored; hence, most artificial teeth are too light. This is unconsciously compensated for by the selection of smaller teeth, which reduces the amount of light reflection from the tooth surfaces.

Saturation is the most variable property of tooth color. Any color scale would therefore contain a wider range of saturation than of brilliance.

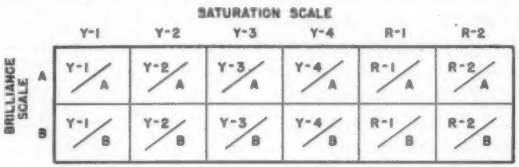

Figure 7.

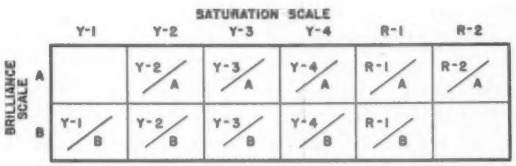

Figure 8.

Color, or hue, could be designated by Y for yellow and R for red. All teeth are basically yellow and some are slightly tinged with red.

A scale of yellows from 1 to 4 could designate the different degrees of saturation of yellow. Y-1 would be the lightest saturation and Y-4 the deepest saturation. Only two degrees of saturation of red would be necessary: R-1 and R-2. The scale of hue and saturation would be as follows: Y-1, Y-2, Y-3, Y-4, R-1 and R-2.

For each degree of saturation, there would be a high brilliance (A) and a low brilliance (B). The coordinate color scale would therefore be as indicated in Figure 7. This system contains twelve colors. From a practical standpoint, however, they are not all necessary. The bulk of the teeth would be of lower brilliance. Therefore, $\frac{Y\text{-}1}{A}$ could be deleted; $\frac{R\text{-}2}{B}$ would be a rare color, and that could be deleted also. The practical scale would be as indicated in Figure 8. These ten colors would cover the entire range in natural teeth.

INTRODUCING DENTISTRY TO THE CHILD

By RALPH L. IRELAND,* B.S., D.D.S., Lincoln, Nebr.

THE impression created in a young child's mind on his first visit to the dentist is lasting, and, in most cases, determines his future attitude toward dentistry and his future behavior in a dental chair. Because the first visit is so important, the dentist's "approach," or "routine," is of vital concern.

While the first appointment routine is significant, it is also imperative that the dentist "follow through" at future visits so that the dentist-child relationship will be strengthened. The confidence and trust which a child has in the dentist should never be jeopardized: once lost, they may never be regained. Consequently, not only the first, but also every association that a child has with dentistry should be, as far as possible, a pleasant experience.

Unfortunately, the dentist is not always given the opportunity to properly introduce himself and dentistry to the child. Some children, because of remarks made by their parents, are partially or completely ruined as dental patients before they ever enter a dental office. Such remarks at the dinner table in the child's presence as "I went to the dentist today and he nearly killed me," or "I have to go to the dentist tomorrow and I know it is going to hurt terribly," are certainly important factors in the child's behavior when he later visits the dentist. Especially is this true if the child has never been to the dentist, because the impression is immediately created in his mind that the dentist is nothing short of a devil; otherwise, why would he want to hurt "Mommy" and "Daddy"?

The majority of children, however, do not, before their first dental appointment, have this kind of background. Either nothing has been said in their presence about dentists or they have been wisely educated by their parents to look upon the dentist as a friend, some one who will help them.

There is no one "technic" or "routine" that can be used to manage all children. Every child is different. There are, however, certain procedures that we can use in our approach which will apply to all children. In order to formulate a suitable technic based on sound principles for our approach, it is necessary that we have some knowledge of: (1) childhood psychology; (2) childhood fears; (3) how children react to certain procedures and situations, and (4) certain of

*Professor of pedodontics, University of Nebraska, College of Dentistry.

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the newer concepts of child training.

Sadler, who thinks that childhood psychology is not easy to master, says, "The child is born with but two or three innate fears: fear of sudden loud and shrill noises, fear of falling, and fear upon sudden arousal from sleep." He says, "The child in the nursery is subject to innumerable fears, but in the majority of cases they fall into the following comprehensive classifications of adult fears: 1. Fear of extinction. 2. Fear of the unknown. 3. Fear of being trapped. 4. Fear of the herd. 5. Religious fears."[1]

Jersild,[2] in observing a group of children between 5 and 12 years of age, observed that they had many unnecessary fears. He grouped them as follows: (1) fear of the supernatural, death, corpses; (2) fear of animals; (3) fear of the dark, new surroundings, new environment, and (4) fear of bodily hurt.

With the help of a group of children between 5 and 12 years, Willard C. Olson, professor of education at the University of Michigan, listed a group of statements about dental office procedures. Each child was asked to check whether he liked, disliked or was indifferent to each procedure. The experiment revealed that these children liked the following:

1. Calling me by my first name when I come in.
2. Showing me all around the office and laboratory.
3. Having magazines, books, paper, pencil and things to play with in the waiting room.
4. Having interesting pictures on the wall.
5. Talking about the things I like to do.
6. Explaining what he is going to do and how he is going to do it.
7. Giving me a mirror so that I can watch the work.
8. Telling me about his instruments and what they are used for.
9. Giving me a signal I can use when it begins to hurt.
10. Stopping when I tell him to.
11. Taking radiographs of my teeth.
12. Using flavor in the mouth wash and cleaning powder.
13. Treating me just as he does a "grown-up."*
14. Keeping my father and mother in the room when he is working.*
15. Giving me tooth paste or some little thing after work is finished.
16. Giving me the teeth that are taken out.
17. Telling me "You are a good patient" or something like that.

They disliked these procedures:

1. Keeping me waiting.
2. Asking questions about my age, grade, school, teacher and birthday to "make" conversation.*
3. Putting all of his tools out in front of me at once.
4. Telling me "It won't hurt" even if it will.
5. Staring at me while he is working.
6. Scolding me for not sitting still or following directions.
7. Making fun of me, calling me a "baby" or anything like that.
8. Comparing me with other children.
9. Trying to be funny or acting silly.*
10. Telling my parents that I was hard to work on.

The National Committee for Mental Hygiene has set forth in contrast the older and newer views concerning child training. Some of the new views that apply to our problem are as follows[3]:

1. Understanding the complex life of a child is a difficult art worth acquiring.
2. Besides the physical care, the child needs a sense of security, understanding and affection.
3. The child inherits traits and tendencies, yet his behavior is largely the result of training and imitation.
4. Even the very young child is profoundly influenced by the moods of those about him.
5. All children should be treated with equal consideration, but each with special regard for his peculiar make-up and needs.
6. Love is a much better basis than fear. Too great fear may cripple. Love does not mean indulgence and pampering.
7. Unwise "don'ts" may provoke misbehavior. Activity should be directed to wholesome pursuits.

*Showed an age difference in reaction.

8. Obedience is not an end. The child should be taught to make wise choices for himself.

9. "Will" is an abstraction, and the child faces concrete choices, desires, obstacles and control of emotions.

10. Repression is dangerous and proper recognition is helpful.

11. A child's questions deserve straightforward answers to establish the right relations.

12. The child reasons from such knowledge as he has and grows in reason by wise encouragement.

Fig. 1.—Reception room of dentist in general practice, showing corner reserved for child patients, whose drawings decorate the wall.

13. True information protects from false and unwholesome attitudes.

From the foregoing, it can be seen that if the child's association with dentistry is to be a pleasant experience, we must take into consideration and incorporate into our technic of approach these features:

1. Appeal to the child's special senses.
2. Recognition of the child as an individual.
3. Proper introduction of instruments.
4. Careful word usage.
5. Comfort of the child in the operating room.
6. Gifts.

THE SPECIAL SENSES

Sight.—Not only children, but also most adults, are afraid of the unknown. The first visit to the dentist is a new experience to the child. He immediately explores his surroundings by looking around the reception room to see what kind of place his mother has brought him to. If, in the first appraisal of his environment, he sees something with which he is familiar, the plunge from his world into the dental world will not be too sudden.

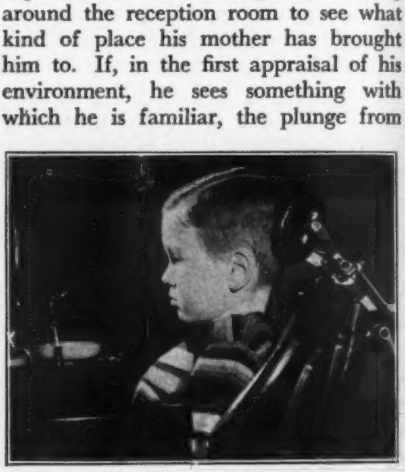

Fig. 2.—Appearance of child in adult dental chair. In this position, it is difficult for the child to relax.

A satisfactory way to set the stage for conditioning the child to his new environment is to reserve a part of the reception room for him. It need not be large, just one corner, in which can be placed a small table and a few chairs, some children's books and some toys. (Fig. 1.) Seeing objects of this type with which he is familiar has the effect of relieving most, if not all, of the child's anxiety, and he decides that the place is not very different from home.

The reception room should also be light, cheerful and clean and the color

combinations appealing. The same applies to the laboratory and the operating room. When the child comes into the operating room, all instruments should be out of sight. A bracket table "loaded down with terrible looking instruments" is not conducive to good child management and does not afford the most pleasant introduction to dentistry. The situation is not unlike being met at the door by a huge, fierce looking dog on visiting a strange house.

Hearing.—Not only what we say, but also how we say it is important in talking with children. A small child can sense displeasure by the tone of voice. We can, by the tone of the voice, help to instill confidence in the child. On the other hand, the tone of voice has much to do with negative reactions in children. That an individual's mood is easily betrayed by the voice is evidenced daily on radio programs. Even though you may be angry or emotionally "upset," never let your voice betray your felings. Your voice should reflect kindness, sincerity and courtesy.

Smell.—The reception room and the operating room should be free from offensive odors. An odor of iodoform or of formaldehyde or some other obnoxious odor has a tendency to cause the child to be apprehensive. Since most children are very critical, the child may inform us in no uncertain terms that "it smells bad around here."

Regarding odors, Pelton says,

> People have always believed and naturally cling to the notion that anything that has a bad odor must be detrimental to health. The odors of medicaments permeating hospitals and doctor's offices excite an uneasy and apprehensive attitude through association with the horror of the place, real or imagined. While the disagreeable odors are not harmful, they should be eliminated from the dental office for esthetic and psychologic reasons.

Taste.—Taste, being closely associated with smell, likewise plays an important part in introducing dentistry to the child. Strong, bad-tasting medicaments should be avoided whenever possible. All mouth-washes, disclosing solutions and pastes used for prophylaxis and polishing silver or gold in the mouth should be flavored. Several drops of oil of wintergreen in a glass of water makes a pleasant mouth rinse. A drop of wintergreen or oil of cinnamon should also be added to the mixture of pumice and water used for polishing silver amalgam in the mouth. Easlick has suggested a formula for a pleasant tasting prophylaxis paste and a disclosing solution:

Prophylaxis Paste	
Flour of pumice	170 gm.
Borax	30 gm.
Glycerin	75 gm.
Carmine	25 gm.
Oil of spearmint	1 drop
Disclosing Solution	
Bismarck brown	3 gm.
Alcohol	10 cc.
Glycerin	120 cc.
Oil of anise	1 drop

RECOGNITION OF THE CHILD AS AN INDIVIDUAL

One of the procedures that children liked in Dr. Olson's experiment was to be treated like a "grown up." All children want to be accepted on the adult level. They may not always want to respond as adults, but they want to be recognized as individuals.

The dentist who talks baby talk and calls a bur a "bee" and the handpiece a "buzzer" is only making himself ridiculous in the eyes of the child. This practice will not build confidence or respect. The child should be greeted with a smile, called by his first name and treated as though he were an important person.

INTRODUCTION OF INSTRUMENTS

When the child first enters the operating room, all instruments should be concealed. As they are needed, they can be taken from the cabinet and the child told the name of each instrument. The child should also be allowed to see and

feel and, whenever possible, be given a demonstration of how the instruments are used. The use of the bur or rubber cup can first be demonstrated on the dentist's fingernail, then on the child's. The explorer can be introduced in a similar manner. The child's finger can be held in front of the mouth mirror to show that the mirror reflects objects and the saliva ejector can be held in a glass of water to demonstrate how it "drinks" water. The dentist can demonstrate how the air syringe works by first blowing air on the child's hand or arm. Before taking roentgenograms, he should explain to the child what he is going to do and that the machine will make a "buzzing sound," stating what he expects of the child. This is a wise precaution in all operative procedures. If children have advance instructions, they cooperate better.

Fig. 3.—Seating arrangement suggested for office having no child's chair.

THE USE OF WORDS

The right words, sincerely spoken, can do much to allay a child's fears and aid in securing the child's cooperation. In dealing with children up to 4 or 5 years of age, the fewer words used in giving commands, the better. In many cases, only one, or not more than two or three will suffice. If too many words are used the child becomes confused. We should say "Sit back," instead of "I can't do anything for you if you keep leaning forward all the time"; say "Open," instead of "Why don't you keep your mouth open?"

Our remarks and instructions to children should be positive. They suggest the correct way of doing things. Sadler says,

> The constant repetition of "don't"—"don't do this" and "don't do that"—is in itself a great producer of fears.[1] We can do much to avoid arousing undesirable negativism in youths by the way in which we approach them. We can give commands with a smile. We can employ indirect intimations in the vein of "Will you do me this favor?"[5]

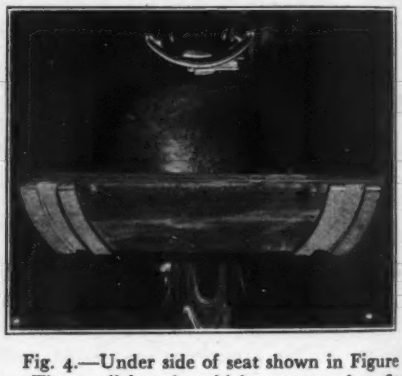

Fig. 4.—Under side of seat shown in Figure 3. The small boards, which are curved to fit the arms of the chair, are padded to prevent scratching.

We should talk to the child on the adult level, avoiding baby talk. We answer all questions truthfully and sensibly and should praise the child, not criticize him. The child should be warned if any part of the operation is to be painful. Commands to small children

need time to "sink in." We cannot expect them to respond immediately, and we should avoid such words as "pain," "hurt," "cut," "slice," "chop" and "blow up" when referring to pulpotomies or pulpectomies.

THE CHILD'S COMFORT IN THE OPERATING ROOM

If the child is to retain a pleasant memory of his visit to the dentist, provision should be made for his comfort while in the dental chair. It is impossible to lower the back and headrest of the average dental chair sufficiently to accommodate children. With the back and headrest in the lowest position, the child's head is thrown forward, so that the chin is almost resting on his chest. (Fig. 2.) It is impossible for the child to relax in this position. A chair that is too big gives the child the impression of being "trapped" or surrounded.

In a seat placed over the arms of the chair, the child is elevated so that his back and shoulders fit the back rest and his head can be properly positioned in the headrest. (Fig. 3.) This makes the whole dental procedure more comfortable and less tiring for the child as well as for the dentist.

GIFTS

Children like to receive gifts. This was clearly shown by Dr. Olson's experiment. Jersild's[6] work also brought this out. The practice of giving children some gift at the end of the dental appointment is one that has recently gained in popularity.

In discussing this practice, Pelton says, "If a child who fears the dentist is given a toy or souvenir at each appointment, he soon learns that the dentist is not a person to be feared, and the unpleasant aspects of the appointment are forgotten."[4]

The dentist should not, however, give gifts to children for good conduct alone. Children should not be "bribed" into being good. If the dentist desires to give souvenirs, every child should be given one regardless of whether he was a good or a bad patient. Souvenirs should be given, as Pelton says, "to make the dental office attractive to children, to interest the shy and apprehensive patient, to improve the behavior of children, to increase the number of children in his practice and to transform the visit into an exciting event."[7]

SUMMARY

To properly introduce dentistry to children, a definite "approach" should be planned so that every association that the child has with dentistry will be a pleasant experience. The following points are suggested for the first as well as subsequent appointments.

I. The Dental Office Environment.

A. The reception room.

1. A special corner should be reserved for the child. A small table and chairs, picture books and a few toys should be provided.

2. The reception room should be light, clean and cheerful.

B. The operating room.

1. The operating room should be clean and free from offensive odors and should be decorated in pleasing colors.

2. Ample time should be allowed for the child to inspect his surroundings.

II. The Special Senses.

A. Sight.

1. There should be a child's corner in the reception room.

2. The reception room and operating room should be decorated in pleasing colors.

3. All instruments should be out of sight when the child first enters the operating room.

B. Hearing.

1. Loud noises should be avoided.

2. The voice should be low and gentle.

3. The voice should reflect kindness, courtesy and sincerity.

C. Smell.

1. The reception room, laboratory and operating room should be free from offensive odors.

D. Taste.

1. Bad tasting medicaments should be avoided.

2. The prophylaxis paste, disclosing solution, mouth rinse and polishing paste should be flavored.

III. Recognition of the Child as an Individual.

1. The child should be approached on the adult level.

2. The dentist should not talk baby talk.

3. Each child should be treated as an individual—a "somebody."

4. The dentist should not compare the child with other children.

IV. The Introduction of Instruments.

1. Every instrument should be properly introduced.

2. The child should be told the name of the instrument and the dentist should demonstrate how it is used.

3. The child should be permitted to feel and handle each instrument.

V. The Use of Words.

1. All questions should be answered truthfully. The child should never be deceived.

2. The bur should not be called a "bee" or the handpiece a "buzzer."

3. The child should be called by his or her first name.

4. Such words as "hurt," "pain," "cut," "blow-up," "chop" and "slice" should be avoided.

5. Remarks should be positive.

6. Commands should be simple.

VI. Chair Seating Arrangement.

1. The average dental chair cannot be adjusted to make the child comfortable.

2. If a junior chair is not available, some other provision should be made.

3. A board made so that it will fit over the handles of the chair will elevate the child so that it will be possible to properly position his head in the headrest.

4. Placing a towel or paper napkin over the seat of the chair will prevent scratching.

VII. Gifts.

1. If gifts are made to one child, they should be given to every child, regardless of behavior.

2. Gifts are made to render the dental appointment attractive.

VIII. Additional Suggestions.

1. Do not keep the child waiting.

2. Greet the child with a smile. With a small child, kneel so as not to "tower" above him.

3. Do not rush the child into the operating room.

4. Be slow and deliberate in your movements. Rapid movements tend to confuse the child.

5. Do not fumble or hesitate. A child will soon sense indecision.

6. Avoid pain at the first appointment. A prophylaxis is a good introduction to dentistry.

7. Make appointments short. Small children cannot cooperate for long periods.

8. Do not expect the child to respond immediately. Requests need time to "sink in."

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ERYTHEMA MULTIFORME BULLOSUM WITH INVOLVEMENT OF THE MUCOUS MEMBRANES OF THE MOUTH (STEVENS-JOHNSON DISEASE)

By Alvin T. Levy, B.A., M.A., D.D.S., San Francisco, Calif.

ERYTHEMA multiforme bullosum is a complex, usually with constitutional reactions. Cases of this disease with mouth involvement are of such rarity as to justify reporting.

Stevens and Johnson,[1] in 1922, reported such a syndrome as an eruptive fever with stomatitis and ophthalmia. Since that time, a few cases have been reported in which the average length of resolution time of the skin lesions was from eighteen to twenty-one days. There was almost no itching or pain and the scalp was free of lesions. In three of the cases, there was formation of bullae. In the case reported by Chick and Witzberger,[2] the condition was accompanied by Vincent's infection. These authors suggest that cases of exudative erythema multiforme reported previously might have a similar etiology, and, further, that if their contention is correct, it would seem logical to employ spirocheticidal therapy.

REPORT OF CASE

A Filipino, aged 27, gave the general impression of being fairly well developed and well nourished. He complained of a sore mouth and large circinate lesions scattered over the body, including the palms. The family history was irrelevant. The patient did not appear to be acutely ill. He had apparently been in good health until three days before entry, when he noted the onset of soreness of the mouth, with dryness, crusting and cracking of the lips. The throat became so sore that eating caused distress. The following day, large ringlike lesions appeared on the back, abdomen and extremities, forming vesicles and then seeming to clear centrally while spreading peripherally. These lesions itched moderately at first and gradually disappeared. The patient had never had a similar ailment nor did he know any one with a similar affliction. His general health had apparently been very good until the onset of the present illness. He said that he had taken good care of his teeth in the past, brushing them twice a day and seeing a dentist about once a year. He stated that the lower left molar region had been a little sensitive recently.

The teeth appeared clean, with the exception of recent deposits. The gingival margins, both upper and lower, and the hard palate and buccal mucosa contained scattered patches of whitish membrane with a surrounding area of erythema that was acutely tender and painful. The local mouth lesions were painted with silver nitrate and frequent mouthwashes of hydrogen peroxide and sodium perborate and glycerin were prescribed. Sulfathiazole was given, plus yeast tablets and orange juice.

The patient recalled that a sore on the penis had appeared during childhood, persisting to the present time, but he stated that he paid no attention to it. He had never received treatment for syphilis as nearly as he could remember. Wassermann and Kahn tests were negative. Since the history was suggestive of venereal lymphogranuloma and soft chancre, a Frei test was given. A negative result was obtained. A Ducrey test was also made, with negative results.

From the Department of Oral Surgery, San Francisco Hospital, Department of Public Health, J. C. Geiger, M.D., Director.

Upon entrance to the hospital, the patient had a temperature of 101.8° F., pulse, 104, and respiration, 20. The skin over the extremities, shoulders, body, inner thigh and left palm showed scattered lesions about 1-2 cm. in diameter, and circular, with a vesicular border and crusting centrally, surrounded by a small zone of erythema. The lymph nodes of the lingual area were pea-sized and non-tender, with a scar over the right inguinal area from a previous suppuration. The head, ears, eyes and nose were negative. The lips were dry, crusted and cracked. The tonsils were reddened and small, but showed no membrane or exudate.

The right submaxillary gland was hard, non-tender and about the size of an olive. The tonsillar and cervical glands were only slightly enlarged and non-tender. The lungs

Fig. 1.—Mouth of patient, showing condition of lips and tongue.

were resonant to percussion. Breathing sounds were clear, with questionable harshening of the sounds at both apices. The heart sounds were of good quality and regular. There were no masses in or tenderness of the abdomen. In the region to the right of the meatus, there was a 1 by 1 cc. area of scar tissue, slightly reddened. The epididymis and testicles were normal and there was no hernia. There was no evidence of rectal stricture, fissures or hemorrhoids. The prostate was of normal size. All the reflexes were equal and normal. The urine was of amber color and clear, with a pH of 6, specific gravity 1.026, and was negative for albumin and for sugar. The red cell count was 200 per field. The urine was negative for casts, crystals and bacteria. The blood examination showed a hemoglobin (Sahli) of 102 per cent, red blood cells, 4,900,000; white cells, 9,600, of which 78 per cent were polymorphonuclears (filamented 70 per cent and non-filamented 8 per cent); lymphocytes 18 per cent, and monocytes 4 per cent.

CONCLUSIONS

The usual cause of erythema multiforme bullosum with involvement of the mouth is an allergic or toxic response to medication, although no such history was obtainable in the case here reported.

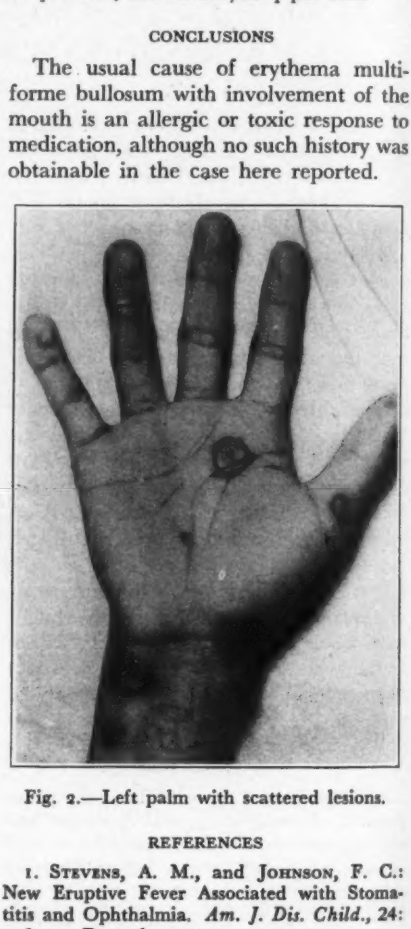

Fig. 2.—Left palm with scattered lesions.

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CAUSE AND TREATMENT OF DRY SOCKET

By WILLIAM E. SHEA, M.D., San Francisco, Calif.

SINCE the publication of my article on treatment of dry socket[1] in September 1940, I have been interested in the nomenclature of dry socket and the possibility that it might add something to the scientific study of the subject to catalogue for future reference the three theories regarding coagulation of blood: (1) the ferment theory; (2) the immunologic theory, and (3) the physicochemical theory.

I shall not go into a description of these theories, as they are available in the usual textbooks of chemical laboratory methods, but would suggest Howell's idea[2] as the most plausible.

The absence of clot formation in dry socket is no doubt symptomatic of a metabolic disturbance due to a lowered vitamin B content in the tissues, which results in a fibrinogen, prothrobin, calcium and blood platelet alteration. Although the platelets may be decreased to 60,000, or less, per cubic millimeter, clots may be of a feathery consistency, disintegrating rapidly owing to avitaminosis, particularly of vitamin B, as observed in the following cases:

Mrs. P. C. The coagulation time was six and one-half minutes; bleeding time, 4 minutes. Vitamin B, 13,333 units, was given. One hour later, the coagulation time was one and one-half minutes; bleeding time, three and one-half minutes.

Mr. J. D. The coagulation time was three and one-half minutes; bleeding time, two minutes. Vitamin B, 20,000 units, was given intramuscularly. One hour later, the coagulation time was two and one-half minutes; bleeding time, two minutes.

Mr. J. D. The coagulation time was three minutes; bleeding time, two and one-half minutes. Vitamin B, 20,000 units, was given intramuscularly. One hour later, the coagulation time was two minutes; bleeding time two minutes.

Mr. O. M. T. The coagulation time was three and one-half minutes; bleeding time, two and one-half minutes. Vitamin B, 20,000 units, was given intramuscularly. One hour later, the coagulation time was two and one-half minutes; bleeding time, two minutes.

Mrs. G. W. F. The coagulation time was four minutes; bleeding time, two and one-half minutes. Vitamin B, 20,000 units, was given intramuscularly. One hour later, the coagulation time was one and a half minutes; bleeding time, one minute.

Mr. P. J. O'S. The coagulation time was four minutes; bleeding time, one and one-half minutes. Vitamin B, 20,000 units, was given intramuscularly. One hour later, the coagulation time was two and one-half minutes; bleeding time, one minute.

Mr. O. J. The coagulation time was four minutes; bleeding time, three minutes. Vitamin B, 16,666 units was given intramuscularly. One hour later, the coagulation time was two and one-half minutes; bleeding time, two minutes.

It would be advisable for the dentist and the physician to give from 5,000 to 50,000 units of vitamin B intramuscularly for the relief of the pain of dry socket. This afforded relief in less than one hour in the majority of eighty-five cases. One patient developed an allergic reaction, which was relieved by a hypodermic injection of 0.5 cc. of adrenalin chloride solution 1-1000.

I made cultures from the dental crypts of these extracted teeth, using blood-agar and Loeffler's coagulated serum and demonstrated only the usual mouth organisms, with the exception of two cases of non-hemolytic streptococci, which were relieved by smaller doses of vitamin B than were used in the other cases.

A history of these cases affords an interesting view in regard to the social status of the individual: More of the middle class are subject to dry socket, while the poorer and the richer classes are practically immune. This anomaly may be due to one of three facts: 1. There are more of us in the middle class. 2. The poorer class eat vitamin B-containing foods from necessity. 3. The richer class have a better balanced diet. Another class is made up of those patients who are dieting to reduce. For the protection of the latter, pharmaceutic products containing vitamin B must be added to the lowered dietary régime.

It is not necessary here to give details as to isolation, symptoms of deficiency, diagnostic methods, tolerance and daily requirement, except to call attention to a salient fact that may be of use in daily practice: The average daily requirements for an adult are from 300 to 600 units of vitamin B, composed of liver, wheat germ, rice polishings, whole grain cereals, whole grain bread, fruits, egg yolk, milk, nuts, legumes, butter, cream cheese, green leafy vegetables, apricots, fresh and dried sweet potatoes and carrots.

It seems to me that dry socket comes in the avitaminosis B_1 class, from the therapeutic test as employed in the relief of anorexia, fatigue, gastro-intestinal hypotonia, beriberi and other polyneuritic conditions. The isoster of thiamine hydrochloride (B_1) has been suggested and worked out by Elderfield and Tracy, of Columbia University.

The vitamin B unit mentioned in this article is thiamine hydrochloride 333 I. U., 1 mg.

It would seem to me from practical and laboratory experience that the best test for vitamin B deficiency is administration of thiamine hydrochloride in sufficient dosage to control the pain of dry socket; that is, from 5,000 to 50,000 units intramuscularly.

The circulating blood consists of a suspension of erythrocytes, leukocytes and blood platelets, in a fluid called plasma. The plasma contains fibrin, which is essential in coagulation of the blood. If the fibrin is removed from the plasma, the remaining fluid is called blood serum.

The soluble blood protein is fibrinogen, which is converted into the insoluble fibrin. Fibrinogen is quite different physically and chemically from the other blood proteins. It is present in the blood in approximately 0.4 per cent, being formed in the liver. Fibrinogen is the globulin, but goes into the insoluble form of fibrin.

Calcium is not necessary for the conversion of fibrinogen into fibrin by thrombin, owing to the fact that sufficient calcium is found in normal blood.

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FEBRUARY 1 *Editorial Department* 1943

MAIL ORDER DENTURES ILLEGAL

AT long last, we have succeeded in procuring legislation directed toward the elimination of a most pernicious and obnoxious encroachment upon the legal prerogatives of the dental profession; namely, supplying dentures by mail order.

On December 24, 1942, the President signed Senate Bill No. 2371; House of Representatives Bill No. 6730, intended to outlaw the mail order denture evil, which has for nearly ten years been a thorn in the side of ethical professional dentistry. We are hopeful that this act on the part of the Legislative arm of the Government will be effective in preventing further unprofessional activities in this field.

As far back as 1932, the practice of dental laboratories, unlicensed to practice dentistry, of furnishing dentures from impressions taken by the person himself came to the attention of the American Dental Association, and the Committee on Legislation, under the able leadership of Dr. A. B. Patterson, then chairman of the committee, undertook to check the practice. The effort at that time was centered upon the activities of one S. B. Heininger, of Chicago, who was the principal offender.

In an effort to check this irregular practice, Dr. Martin Dewey, then President of the American Dental Association, endeavored successfully to interest the Post Office Department in the matter to the extent of issuing a fraud order against the offender. The effect of the fraud order, however, was to stimulate the ingenuity and cunning of the counsel for the defendant, with the result that the fraud order was practically invalidated. Several similar cases arose over several years, and efforts to stop them through prosecution met with the same fate. The difficulties encountered in applying the fraud order effectively to more than one instance was that the post office fraud order applied only to some specific fraudulent statement in an advertisement; and in order to evade a standing fraud order, the individual or concern involved had only to change the wording of an advertisement so that it was not substantially the same as that covered by the fraud order. It finally became evident to the Legislative Committee that any effective enforcible restrictions upon the mail order denture "industry" would have to come through Governmental legislative channels.

Accordingly, in 1942, Dr. Patterson, chairman of the Committee on Legislation, appeared before the Board of Trustees of the American Dental Association and asked authority to proceed with the effort to secure legislation directed toward eliminating this illegal practice. Most of the mail order denture culprits, ten in number at the present time, are located in the state of Illinois, and consequently this particular state has borne the brunt of the fight against this obnoxious practice.

In 1942, however, Representative Philip A. Traynor, of Delaware, himself a dentist, became interested in the matter and volunteered to sponsor a suitable bill through the House of Representatives. Senator Tunnel, also of Delaware, volunteered to sponsor a similar bill through the Senate, and in December 1942, the following bill, known as S. 2371 and H. R. 6730, was passed. It was signed by the President on December 24, 1942.

AN ACT

To protect the public health by the prevention of certain practices leading to dental disorders; and to prevent the circumvention of certain State or Territorial laws regulating the practice of dentistry.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That it shall be unlawful, in the course of the conduct of a business of constructing or supplying dentures from casts or impressions sent through the mails or in interstate commerce, to use the mails or any instrumentality of interstate commerce for the purpose of sending or bringing into any State or Territory the laws of which prohibit—

(1) the taking of impressions or casts of the human mouth or teeth by a person not licensed under the laws of such State or Territory to practice dentistry;

(2) the construction or supply of dentures by a person other than, or without the authorization or prescription of, a person licensed under the laws of such State or Territory to practice dentistry; or,

(3) the construction or supply of dentures from impressions or cases made by a person not licensed under the laws of such State or Territory to practice dentistry,

any denture constructed from any cast or impression made by any person other than, or without the authorization or prescription of, a person licensed under the laws of the State or Territory into which such denture is sent or brought to practice dentistry.

SEC. 2. As used in this Act, the term—

(1) "Denture" means a set of artificial teeth, or any prosthetic dental appliance;

(2) "Territory" means any Territory or possession of the United States, including the District of Columbia and the Canal Zone;

(3) "Interstate commerce" means (1) commerce between any State or Territory and any place outside thereof, and (2) commerce within the District of Columbia or within any other Territory not organized with a legislative body.

SEC. 3. Any violation of any provision of this Act shall be punished by a fine of not more than $1,000, or by imprisonment for not more than one year, or by both such fine and imprisonment.

Approved, December 24, 1942.

The opposition to this bill was well organized and quite strong. At the six-day hearing on the bill, every means that could be devised by able and resourceful legal talent was employed to defeat the bill, but, we are happy to say, without success. While the unfair and unprofessional character of the mail order denture practice is apparent to every practitioner, it is difficult to educate some classes of the public regarding its harmful nature, and it is also difficult to obtain the attention of the lawmakers sufficiently long to induce them to pass corrective legislation. However, when we have attracted their attention to our particular legislative needs, it is not overly difficult to convince them of the merits of our claims as an important health service. The educational influence upon the public and upon the legislative branch of the government through the contacts made in the interest of dentistry in seeking this legislation should and, we believe, will be of great value to the profession in future legislative efforts.

The two particular features of the bill are its public health aspect and the support of the principle of states' rights. All that will be

necessary now to stop the mail order denture practice in any state is to prove that the dentures in question are made and transported interstate in violation of state laws.

The chairman of the Committee on Legislation, Dr. Sterling V. Mead, Washington, D. C., has requested us to extend the thanks of the committee to the Trustees and Officers of the American Dental Association and to all members of the Association who have helped in this movement, and to the Department of Justice, Post Office Department, the Bureau of Standards and the Federal Trade Commission, for their helpful cooperation.

The chairman wishes also to extend particular and whole-hearted thanks to Congressman Philip A. Traynor, of Delaware, and to Senator Tunnel, of Delaware, for their graciousness in sponsoring the bill and for their able efforts in promoting its passage.

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Publication Committee, H. TRENDLEY DEAN and PAUL C. KITCHIN. Edited by FOREST RAY MOULTON. Illustrated. 101 pages. Price $3. The Science Press Printing Company, Lancaster, Pa.

STUDIES of the effects of fluorine on tooth development and dental caries have led to numerous and lengthy discussions in the past decade. From a purely scientific point of view, dental fluorosis is interesting, for it illustrates the fact that minute quantities of fluorine affect the teeth, in an apparently beneficial manner if in very limited quantities, and in a harmful way if in slightly greater concentrations. As a public health problem, dental fluorosis is attracting the attention of the public and governmental agencies as well as dentistry.

To summarize investigations in this field, the Committee for the Subsection on Dentistry of the American Association for the Advancement of Science planned the program for the 1941 meeting under the title "The Public Health Aspects of Dentistry, with Special Reference to Fluorine." Speakers on this program included twelve men who are well known in dental research, and who had studied and previously reported on some aspect of the problem of dental fluorosis.

The early studies of dental fluorosis were reviewed by Frederick S. McKay who, with G. V. Black, wrote the first article in dental literature on this subject. H. Trendley Dean, of the U. S. Public Health Service, outlined the geographic distribution of dental fluorosis. The chemistry of fluorine as related to fluorosis was discussed by H. V. Smith of the University of Arizona. Dr. Schour, of the University of Illinois, and Margaret Cammack Smith, of the University of Arizona, reporting on experimental dental fluorosis, showed that changes in the incisors of rats similar to mottling of enamel in human teeth can be produced experimentally by the use of fluorine. These authors warned that

Any plan to build caries resistance into teeth by the addition of fluorides to public water

supplies as a public health procedure is extremely hazardous. The range between toxic and non-toxic levels of fluorine is of such small order as to make even the continuous use of fluorine dentifrices a probable danger. (Page 47.)

H. B. Younger, of Dallas Texas, explained a treatment for bleaching mottled enamel by the use of a mixture of 5 parts of 30 per cent hydrogen peroxide and 1 part ether. This mixture is applied to the tooth on cotton rolls (a rubber dam is used) and the solution volatilized by a hot instrument.

Wallace D. Armstrong described the chemical studies of mottled teeth made in the University of Minnesota, Laboratory of Dental Research. His results seemed to prove that the ingestion of fluorine reduced dental caries in the rat, and suggested that continued studies on the effect of fluorine ingestion in human beings might prove valuable.

In the paper, "Fluorine and Dental Caries, with Special Reference to L. Acidophilus," Philip Jay, of Ann Arbor, pointed out that accumulating data suggest the possible control of dental caries by treating the water supply, but it is "also quite apparent that there is still much to be learned before caries control by this means becomes a reality." (Page 66.)

Gerald Cox and Margaret Levin, of the Buhl Foundation of Miller, summarized the relationship between fluorine and caries. They conclude that "caries resistant teeth can result from preeruptive diets; that fluorine is one factor in the construction of such caries resistant teeth, and that a post-eruptive effect of fluorine, under normal conditions, is yet to be demonstrated." (Page 72.)

Studies of the problem made in the School of Medicine and Dentistry, Rochester University, were briefly reported by J. F. Volker, who stated that further evidence would be needed to prove the value of fluorine used posteruptively in preventing dental caries.

A paper entitled "Mottled Enamel from the Standpoint of Public Health Studies made in Illinois" was read by Charles F. Deatherage, of the Illinois State Department of Health. Investigations on the problem have been carefully made by Dr. Deatherage and his co-workers.

This monograph is carefully prepared and printed and should be carefully studied by every one interested in dentistry and public health and in the relation of fluorine to dentistry. The American Association for the Advancement of Science can be thanked for sponsoring the symposium and for publishing the proceedings of the meeting.

M. K. H.

The Care of the Aged (Geriatrics)

By MALFORD W. THEWLIS, M.D. Attending Specialist, General Medicine, United States Public Health Hospital, New York City; Attending Physician, South County Hospital, Wakefield, R. I. Special Consultant, Rhode Island Department of Public Health. Fourth Edition, thoroughly revised. 35 illustrations; 589 pages. Price $7. C. V. Mosby Company, St. Louis, 1942.

GERIATRICS is a generally neglected field in this country, although the 1940 census shows that there are more than 8,956,000 people in the United States over 65 years of age. This represents an increase of 35 per cent in this age group since 1930, and there are indications that the number of people over 65 is going to continue to increase.

The author of this book, "The Care of the Aged," believes that "senility is a physiologic entity like childhood, not a pathologic state of maturity." He declares that "the object of treatment of disease in senility is to restore the diseased organ or tissue to a state normal in senility, not to the state normal in maturity." Therefore, he believes that the aged deserve especial care and treatment.

The physiologic and pathologic changes in old age are considered, as well as nutrition, infectious diseases, focal infection, sex problems, cancer surgery, etc., from the viewpoint of care of the aged. The author insists that "diseases in senility are pathologic conditions in a normally degenerating body, not diseases such as occur in maturity complicated by degenerations."

More than thirty charts and tables simplify the subject matter. The illustrations are not particularly well reproduced, but are carefully chosen.

One short section written by Herschel Glick, D.D.S., is devoted to care of the teeth of the aged. Dr. Glick states that "complete absence of teeth is better than teeth which irritate and by constant annoyance consume

much needed energy." He believes that the importance of mastication among the aged is frequently overrated.

The general attitude of the author toward the aged is one of tolerance, and his philosophy regarding treatment of their diseases is valuable. The book should be read by everyone who must treat the aged.

M. K. H.

Microbiology and Man

By JORGEN BIRKELAND, Ph.D. Assistant Professor of Bacteriology, Ohio State University, Columbus, Ohio. Cloth. 478 pages; 34 illustrations. Price $4. Williams and Wilkins Company, Baltimore, 1942.

THIS new textbook, written by a prominent scientist and teacher in the field of bacteriology, will prove popular with readers who wish to gain an understanding of the rôle played by micro-organisms in everyday life. The author discusses the fundamentals of microbiology, and introduces the subject of infection and resistance. More than one-half of the book is devoted to a consideration of the common infectious diseases, and the bacteriology of food, milk and water. A brief outline of the various genetic groups of bacteria of the class schizomycetes, a glossary of about 250 bacteriologic terms and a selected list of reference books are included in the appendix.

This book is designed as an elementary textbook for the student who plans to take but one or two courses in microbiology. It is not comprehensive enough to serve as a text for medical or dental schools. No details of laboratory procedures are given.

The book is easy to read and presents much general information concerning microbiology and in a manner understandable by any college student.

M. K. H.

Abstracts of Food and Nutrition Research.

Biological Abstracts announces a new (seventh) section, "Specially Assembled Abstracts of Food and Nutrition Research," to be initiated in January 1943. This section will reprint all the abstracts contained in *Biological Abstracts* that deal with human and animal nutrition and metabolism, vitamins, diet and diet-deficiency diseases, food composition and values, food processing and food microbiology, beverages, storage and conservation of foods and food spoilage; in short, all of the biologic literature that pertains to foods and nutrition.

Biological Abstracts has covered this literature ever since its establishment in 1926. In previous volumes, the abstracts pertaining to foods and nutrition have been dispersed throughout the entire volume; hence, research men and teachers whose special interests lay in the foods-nutrition field were able to obtain the abstracts pertaining to this literature only through the purchase of the complete edition or all of the five original sections. The segregation of the foods and nutrition abstracts into this independently published section will provide, for the convenience of these workers and biologists generally, an abstracting service at greatly reduced cost.

In line with the general policies of *Biological Abstracts,* every possible effort is being made to insure completeness in coverage of the literature. Efforts to obtain abstracts of publications from continental Europe, now mostly unavailable to workers in this country, are continuing. In spite of the great restriction in diffusion of research information occasioned by the war, journal coverage in *Biological Abstracts* has steadily increased until, at present, more than 1,700 periodicals in the biologic field are being abstracted. The new abstract section will therefore, from the beginning, afford a complete coverage of the research literature.

Each volume will consist of ten abstract issues. Subscribers will receive the index to the complete edition of *Biological Abstracts.* The subscription price will be $6 a year (plus 50 cents for postage outside the United States).

Inquiries should be addressed to *Biological Abstracts,* University of Pennsylvania, Philadelphia, Pa., U. S. A.

Anatomy of the Human Body

By HENRY GRAY, F.R.S., Late Fellow of the Royal College of Surgeons; Lecturer on Anatomy at St. George's Hospital Medical School, London. Edited by WARREN H. LEWIS, B.S., M.D. Member Wistar Institute of Anatomy and Biology, Philadelphia, Pa. Ed. 24, thoroughly revised. Imperial octavo, 1,428 pages. Illustrated with 1,256 engravings. Buckram. Price $12. Lea and Febiger, Philadelphia, Pa., 1942.

IT seems almost unnecessary to write a review of this book. One need only mention that a new revised edition of "Gray's Anatomy" is available, for it has been a standard reference book since the first edition was published, in 1858. Incidentally, the original edition had 750 pages and 363 figures; the twenty-fourth has 1,428 pages and 1,256 illustrations.

This latest edition is notable for a few innovations. Six distinguished anatomists have been appointed to the editorial staff as associate editors. These men, authorities in their fields, revised, rewrote and made additions to the text. They are E. T. Engle, Ph.D., Columbia University (the ductless glands); J. C. Hinsey, Ph.D., Cornell University (nervous system); N. L. Hoerr, Ph.D., Western Reserve University (blood vascular system); K. E. Mason, Ph.D., University of Rochester (respiratory and digestive systems); D. K. McK. Risch, M.D., Washington University (central nervous system), and R. C. Williams, M.D., University of Pennsylvania (the urogenital systems).

For the first time, roentgenograms are included in the section on "Surface and Topographical Anatomy." It is true that radiography plays an important rôle in medicine and surgery. The editors apparently believe that a correlation of radiography and anatomy is in order.

The descriptions of the head and neck structure are detailed and thorough, although certain of the terms employed are not in common usage in dentistry. Examples are: cement or crusta petrosa (for cementum); successional permanent teeth (those replacing deciduous teeth); superadded permanent teeth (permanent teeth distally from the deciduous teeth), and dental canaliculi (dentinal tubules. One typographical error (prodentine for predentine, page 1143) was noted.

The format of the previous editions has been retained. Important details are described in large type, and supplementary data are printed in small type. The illustrations, although not so spectacular as those in some atlases of anatomy, are clear, carefully drawn and well labeled.

The latest edition of "Gray's Anatomy" is a reference book for the study of the human body unexcelled in accuracy and clarity.

Synopsis of Full and Partial Dentures

By ROGER G. MILLER, D.D.S., Lieutenant Colonel, Dental Corps, U. S. Army; officer in Charge of Prosthetic Department, Army Dental School, Army Medical Center, Washington, D. C. 220 pages, 107 illustrations. Cloth. Price $3. C. V. Mosby Company, St. Louis, Mo., 1942.

IN this neat little book, a simple, adequate technic is described for the construction of complete and partial dentures which can be adapted to equipment and supplies furnished dentists serving in the U. S. Army. The author states that he recognizes the value of facebows, fully adjusted articulators, etc., but he feels that the necessity for their use is frequently overemphasized. In this book, therefore, the importance of fundamentals in denture construction is stressed, rather than the importance of any certain instruments.

The value of preparing the mouth for complete dentures is tersely discussed. The author comments that it is becoming the policy of the Army Dental Corps to require oral surgeons to serve periods of time in prosthetic clinics to enable them to understand better the problems of the edentulous mouth, and to appreciate the factors involved and the necessity for proper ridge preparation.

The technics of impression taking, determining vertical dimension and securing centric relation, designs of dentures and maxillofacial prosthesis are briefly considered. The book is carefully illustrated. Every other page (on the average) contains a picture. When one remembers its size and its purpose, the book is a notable achievement. Certainly every army dentist should study this synopsis of complete and partial denture construction, and many dental practitioners will find it helpful.

M. K. H.

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WAR SERVICE COMMITTEE

THE War Service Committee presents herewith releases from the Directing Board of the Procurement and Assignment service, and from the Surgeon General of the United States Public Health Service, describing the cooperative policy of Procurement and Assignment Service and the United States Public Health Service in meeting medical and dental care shortages.

C. WILLARD CAMALIER,
Chairman.

WAR MANPOWER COMMISSION

PROCUREMENT AND ASSIGNMENT SERVICE

Procurement and Assignment Service; Cooperative Policy by Procurement and Assignment Service and United States Public Health Service in Meeting Medical and Dental Care Shortages.

Because of shifts in population and the enlistment of many physicians in the armed forces, medical and dental care shortages exist in some areas of the country. The Procurement and Assignment Service and the United States Public Health Service are, therefore, cooperating in the appraisal of medical care in extra cantonment, war industry and other areas where medical and dental personnel are reported to be insufficient. Definite ways for meeting these needs will be worked out.

Information concerning such areas comes from many sources. It is understood that whenever such information comes to the attention of either the the regional office of the United States Public Health Service or the state office of the Procurement and Assignment Service, whichever agency first obtains this information will report it to the other, and plans will immediately be made to investigate these areas. Such investigations will be made by the two offices mentioned in cooperation with (1) the Corps Area Chairman of Procurement and Assignment Service and (2) a representative delegated by the state medical society or, as the case may be, the state dental society.

It has been specifically agreed by Procurement and Assignment Service and United States Public Health Service that the first urgent step in this program is to secure and/or maintain a ratio of at least one active physician to each 3,000 population. This ratio represents one-half of the agreed upon minimum overall standard of adequacy for the care of the civilian population and, therefore, less than this ratio obviously represents a dangerous deficiency.

Reports of such joint studies will be submitted to the Central Office of Procurement and Assignment Service and the Surgeon General of the U. S. Public Health Service simultaneously. They should be signed by the representatives of Procurement and Assignment Service (corps area and state) and of the United States Public Health Service making the survey. Proposed recommendations of the representatives of both agencies should be made on the basis of the study after discussion with a representative group of the citizens of the area involved. Such recommendations should accompany the report to be made to the central headquarters of each agency. If there is a lack of agreement in regard to

the recommendations, such differences should be indicated in the report. The report should include the numbers of physicians, dentists, auxiliary personnel and facilities at the time of the study, and the numbers needed. The recommendations should be specific and not general as to the plan of meeting the need. Recommendations will not always concern additional physicians or dentists, but may deal with the possibilities of spreading the services of physicians already in the community by making available some type of auxiliary services such as hospital facilities, nursing services and medical offices and equipment. In other instances, the need may be for the expansion of United States Public Health Service facilities.

In carrying out these programs, the state chairmen will need the assistance of other individuals. It was recommended that the state chairman organize an advisory committee consisting of representatives of the Procurement and Assignment Service, of the state health department, and where indicated, of management, labor, etc. To this advisory committee should be added the state medical director of Civilian Defense.

Many situations where shortages exist can be met through local effort by relocation of physicians living within the state. Where this is not possible, Federal assistance may be necessary. The supplying of such assistance by the United States Public Health Service is subject to certain regulations and is affected by state laws, more particularly those covering state health departments.

Details of these arrangements have been presented to the district directors of the United States Public Health Service by the Surgeon General. A copy of the Surgeon General's memorandum on this subject is attached.

UNITED STATES PUBLIC HEALTH SERVICE

Surgeon General United States Public Health Service. Operating policies on matters relating to shortages of medical and allied personnel, relationships with Corps Area and State Procurement and Assignment officials and functions of the Division of States Relations, United States Public Health Service, in this field.

1. The United States Public Health Service and the Procurement and Assignment Service will jointly undertake studies of war industry and extra cantonment areas from which shortages of medical and allied professional personnel are reported.

(a) These studies shall be made jointly by the appropriate corps area chairman of Procurement and Assignment Service, state medical and dental chairman of Procurement and Assignment Service and representatives of the United States Public Health Service, either the district director or some one detailed by the district director or by the Surgeon General. Also the state medical society, the state health department and, when needed, the state dental society, each will be invited to designate a representative to participate in such studies.

(b) District directors of the United States Public Health Service should take the initiative in contacting state and corps area chairmen of Procurement and Assignment Service in seeking to arrange for such studies. The Procurement and Assignment Service will take the same initiative if information concerning a critical area comes to its attention first.

(c) The Procurement and Assignment and the United States Public Health Service are agreed that the first urgent step is to insure that there is at least one active physician to each 3,000 people. Less than this ratio, which represents only one-half of the agreed upon standard of adequacy for care of the civilian population, obviously represents a dangerous deficiency.

(d) The findings and proposed recommendations of the survey group should be discussed with a representative group of citizens of the area involved before

the report is submitted to Washington.

(e) Recommendations will not always concern additional physicians or dentists, but may deal with the possibilities of spreading the services of physicians already in the community by making available some type of auxiliary services such as hospital facilities, nursing services and medical offices and equipment. In other instances, the need may be for the expansion of public health facilities.

(f) Reports of joint studies shall be submitted to the Central Office of Procurement and Assignment Service and to the Surgeon General simultaneously, and should be signed by the representatives of Procurement and Assignment Service and United States Public Health Service making the survey. If representatives making the joint report cannot reconcile differences of opinion regarding the recommendations made, these differences should be indicated in the report. Recommendations should be specific and not general as to the plan for meeting the need, including the number of physicians, dentists, auxiliary personnel and facilities.

2. Many situations where shortages exist can be met through local effort by the relocation of physicians living within the state. It is in areas to which physicians must be transplanted from other states that Federal assistance most often will be needed.

3. Licensure for doctors moving interstate will be a difficult problem in some states. However, conferences with Procurement and Assignment Service and state licensing boards may provide means by which out-of-state physicians may be granted temporary permits to practice medicine in shortage areas for the duration of the emergency.

4. The General Counsel's office, in an opinion dated July 28, 1942, states that under the authority of Title VI, Social Security Act, the U. S. Public Health Service may detail its personnel to a state to render medical services "provided the public agency to which these officers are detailed has authority under the law of that state to . . . engage in the activities contemplated therein." This arrangement should be used in areas where other means of giving medical aid cannot be arranged.

5. The U. S. Public Health Service usually cooperates with the state health departments; therefore, the question will arise, in considering the detail of personnel to "cooperate with and assist the state" by rendering medical services in war industry and extra-cantonment areas, whether the state health department has the authority to engage in this type of activity. The General Counsel's office is of the opinion that most state statutes fail to indicate either positively or negatively what the state health department's responsibility is with regard to this subject. Hence, it may be necessary for the state health officer to make an administrative decision concerning this point.

6. On recommendation of the state health officer and with the approval of the district director after consultation with the state chairman of Procurement and Assignment Service, personnel now assigned to state health departments under Emergency Health and Sanitation may be assigned to render medical services in areas where shortage exists. In making such assignments, district directors will review the total needs in their respective districts and attempt to meet the most urgent ones.

7. When making reconnaissance surveys of war industry and extra-cantonment areas on their own initiative, district directors will concern themselves, as in the past, with shortages in such areas of medical and allied personnel.

8. The Community Medical and Dental Service Section has been established in the States Relations Division to serve:

(a) In a liaison capacity between the U. S. Public Health Service and the Procurement and Assignment Board concerning medical care problems in war industry and extra-cantonment areas.

(b) In an advisory capacity to district directors concerning local plans for providing and utilizing physicians and allied personnel to render medical care.

(c) As a coordinating office with respect to the various medical care interests of the service, other than those dealing with established beneficiaries.

Senior Surgeon Carl E. Rice is in charge of the Community Medical and Dental Service Section. Assistant Surgeon J. M. Chisolm and Health Administrative Specialist Irma M. Ringe are also attached to this section.

9. The Community Medical and Dental Service Section should be kept currently advised concerning plans that are being devised and actions taken to alleviate medical care shortages. Such plans may represent the joint efforts of local medical societies, public health departments, hospitals, visiting nursing associations, councils of social agencies, etc.

10. The Budget Bureau will consider making special allocations from the President's Emergency Fund for particular areas in need.

WAR SERVICE COMMITTEE MEETING

THE War Service Committee of the American Dental Association will hold a conference during the Midwinter Meeting of the Chicago Dental Society at the Palmer House, Chicago, Ill., Saturday, February 20, at 9:30 a. m.

Prominent officials of the armed forces and others will speak on subjects pertinent to the war effort.

All Procurement and Assignment Service, Military Affairs Committee chairmen and members, representatives of dental societies, state boards of dental examiners, deans of dental schools and others are invited to be present.

ARMY RANK FOR DENTISTS ON INITIAL APPOINTMENT

The Surgeon General of the Army has published from time to time detailed information concerning policies governing the initial appointment of dentists as dental officers, and physicians as medical officers.

Because of changes occurring in the military situation and in the civilian requirements, it is contemplated that changes will be required in the standards for the initial grade of medical officers. It is expected that, in the near future, those eligible under the age of 38 years will be appointed in the grade of first lieutenant only and that those in the age group 38 to 45 will be appointed in numbers and in the grades for which such position vacancies exist.

Appointments of dental and medical officers by medical officers' recruiting boards have been discontinued. However, the boards now active are to continue soliciting applications. All applications are forwarded to the Surgeon General for final recommendation of appointment.

BUREAU OF PUBLIC RELATIONS

DENTAL CARIES: CAUSES, PREVENTION AND CORRECTION*

DENTAL caries, or dental decay, the disease that causes destruction of the teeth, is one of the commonest of human ailments, only 2 or 3 per cent of the population ever escaping it entirely. Unlike most diseases, it has become more prevalent with the progress of civilization. The past half century has brought many of the scourges of mankind, such as smallpox, tuberculosis and typhoid fever, to a stage where they can be controlled if adequate social action is taken, but this is not yet the case with dental decay. Thus, while preventive measures are reducing the significance of these and other diseases, disabling ailments such as dental caries, which were previously considered unimportant, are becoming of prime importance to the health of the nation.

Cause.—All diseases are the result of an attack on any particular part of the body by forces stronger than those working to maintain its health. However, decay of the teeth differs in one way from other diseases, in that the enamel and dentin of the teeth are so highly mineralized that they do not have a blood supply. Therefore, when attacked, they do not, like other tissues or organs, benefit from the defensive reactions. In other words, there is no active mechanism by which the teeth can defend themselves from attack or by which they can repair injuries. Actual measurements show that the amount of nutritive material passing into the dentin is about a tenth of that reaching bone, and that enamel receives only about one tenth of the nutriment passing to dentin. As a result of this very limited reactivity of dental tissues, the power of the attacking forces determines almost entirely the progress of dental caries.

This is not the case with other diseases, in which the blood can carry leukocytes, bacterial antibodies or even drugs to the site of infection in an effort to bring the disease under control. This does not mean that we can entirely ignore the resistance of the tooth to the forces of decay, because, if a tooth is well formed, it may resist destruction when otherwise cavities would have formed in it. Thus, a perfectly formed tooth such as should develop in a person enjoying good health and adequate nutrition should be less liable to decay than a poorly formed tooth. Similarly, when the health and nutritional state are satisfactory, defensive reactions in the dentin may be sufficiently strong to prevent further progress of caries. Except for their action in modifying the composition of the saliva, it has not been shown that health and nutrition influence the progress of destruction of the more highly calcified and less vital enamel. In short, the resistance of the body cannot play so important a part in preventing or curing dental decay as it does in other diseases.

There is little doubt that the direct cause of dental decay is the breakdown

*The growth of public interest in dental health has resulted in a marked increase in requests for information on different phases of the subject. To meet this demand, the Public Health and Education Committee, now a subcommittee of the Council on Dental Health, has authorized the preparation of a series of twelve articles in pamphlet form, each article to deal with one of the dental questions most frequently asked by the public.

"Dental Caries: Causes, Prevention and Correction," by Basil G. Bibby, is the second of this series. Reprints at nominal cost can be obtained by addressing the Bureau of Public Relations, American Dental Association, 212 E. Superior St., Chicago, Ill.

of carbohydrate foodstuffs on the surfaces of the teeth. There are two principal reasons for this belief: The first is that the areas on the tooth surface where carious cavities develop are those in which food accumulates. The second is that science knows of only one means by which the enamel of the tooth can be destroyed, and that is the action of acid. Therefore, the breaking down of foodstuffs in the mouth, forming acids, is the potential cause of dental decay. Protein foods, such as meat or eggs, do not give rise to such acids, which are formed only as the result of bacterial action on carbohydrates, such as sugar and flour, or the

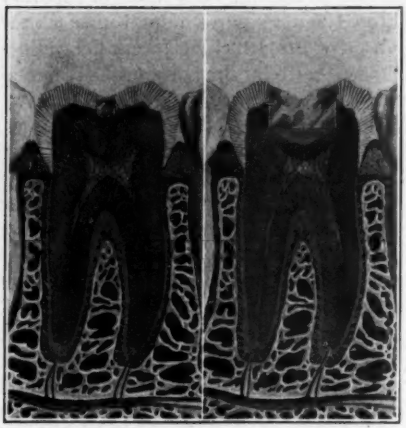


Fig. 1.—The detection and correction of small defects (left) preserves tooth structure and prevents the need of large fillings (right).

foodstuffs in which these substances are contained. The formation of acids begins as soon as the carbohydrates come in contact with the bacteria on the teeth and continues until the carbohydrates are completely destroyed by the bacteria or until they are washed from the mouth. Because of this, an abundant flow of saliva, which will help to wash foods from about the teeth, will tend to prevent dental decay. Less food will accumulate about teeth of good shape and which are in correct position and they will therefore be less liable to decay. It is by modifying the form and position of the teeth that heredity has some influence on caries. Heredity may also have an influence on the tendency to caries for other reasons, but this has not been established. Some carbohydrate foods adhere much more firmly and in greater amounts to the teeth than do others, and will therefore be more likely to serve as sources of decay. Other chemical and physical factors in the foods about which little is yet known may also help to determine the importance of different items in the diet in the causation of caries. Whatever the modifying factors, however, it is true that the less carbohydrate foodstuffs are in contact with the teeth, the less will the teeth decay. It may be further stated that after the teeth are completely formed, other factors, such as nutritional deficiency, play only a secondary rôle in dental decay.

Treatment.—Unlike other parts of the body, such as skin or bone, the calcified portions of the teeth are not furnished with a system of blood vessels, carrying a constant supply of nutriment. Consequently, their ability to repair injury is very slight, and when decay causes cavities in the enamel or dentin, repair never is undertaken by the natural healing processes of the body. At best, the cavities will reach a certain size and progress no farther. At worst, they will destroy the whole tooth and cause infection of the adjacent bone or some distant part of the body. Even if the tooth is not completely destroyed, its jagged remains may irritate or injure the tongue, lips or cheek, predisposing them to the development of cancer.

Obviously, it is desirable to prevent any of these untoward developments. Once dental caries has developed in the tooth, the only known way of eradicating it and restoring the tooth to full function is to have the tooth "filled" by a dentist. This operation is not, as the name suggests, merely a matter of filling the carious cav-

ity with some filling material. As in all surgical procedures, it requires the removal of all unhealthy tissue around the starting point of the disease. In the teeth, such a procedure is complicated by several conditions. One of these is the fact that the operation has to be carried out on the hardest structures of the body. As a result, operations cannot be carried out with scalpel or scissors, but grinding, more tedious and difficult, has to be employed. The restricted space in which the operations have to be performed adds another complication, as does the fact that the teeth apparently do not have the power to overcome residual infections as do those parts of the body through which the blood circulates. Because the teeth are subjected to great physical stress when they are brought together during chewing, fillings must be designed according to certain mechanical principles to withstand pressures of 200 to 300 pounds. This sometimes requires the cutting away of sound tooth substance and the use of different filling materials, according to the particular circumstances. Such a procedure is, of course, necessary to assure satisfactory and permanent restoration of function. These special problems can be met only by the use of special knowledge and skill and special apparatus. It is to supply these that the profession of dentistry has developed.

While the best tooth is the sound tooth, the next best tooth is the tooth with the slightest possible restoration. Every one benefits if caries is treated before it becomes too extensive. The problem of the removal of decay, choice of filling materials and the complete restoration of mechanical function are simplified for the dentist. The patient is saved the discomfort of lengthy operations and benefits from the lowered cost of treatment. Obviously, the smallest cavities should be treated, and in order that the dentist may detect and treat such beginning decay, periodic visits to the dentist are recommended, even though the patient may have no reason to suspect any trouble.

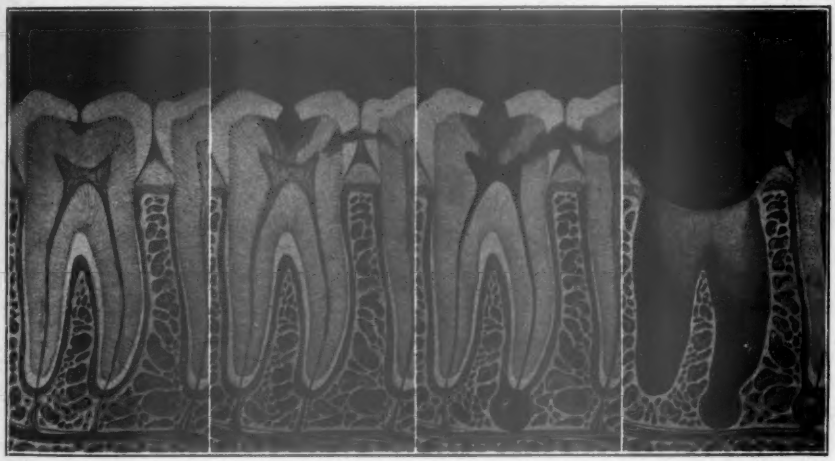


Fig. 2.—The picture at the extreme left illustrates how the presence of food in a defective groove between the teeth can cause the beginning of decay. Unless corrected the condition usually grows worse, resulting in the loss of the tooth.

Prevention.—Prevention is, of course, better than treatment. However, the den-

tist can do little beyond giving advice, and the success of any program of prevention depends almost entirely on the faithfulness with which it is followed by the patient. Much can be done to prevent dental decay. Since dental decay is principally the result of food accumulation on the teeth, this accumulation should always be kept at a minimum. This may be done in several ways. First, whenever possible, teeth should be brushed immediately after any sweet or sticky foodstuffs are eaten. Brushing the teeth before breakfast contributes nothing to the prevention of dental decay, but is recommended for refreshing the mouth before eating. Second, whenever possible, foods with a low content of readily

Fig. 3.—It is quite possible that America's high sugar bill accounts for many of our national dental ills.

fermentable carbohydrate should be substituted for those containing much sugar or refined flour. Third, in choosing foods, preference should be given to those which do not adhere to the teeth. Some foods such as fruits and vegetables, leave the mouth feeling clean; others, such as cookies or chocolate, stick to the teeth for a long time after they have been eaten. It is not necessary to list the sticky and the non-adhesive foods, because any one can tell which is which by observation in his own mouth. It is worth mentioning, however, that raw vegetables and fruits, particularly apples, not only do not stick to the teeth, but chewing them actually helps remove the sticky foods from about the teeth. Indeed, eating an apple or some raw vegetable after a meal or after partaking of candy and other foods containing fermentable carbohydrates is a good way to clean the teeth. Such measures of oral hygiene can frequently be carried out, particularly in children, when toothbrushing is not possible. It is of paramount importance to choose non-sticky foods for between-meal snacks and whenever possible to end meals with such foods. If candy must be eaten, and it is almost impossible to deny it to children, it should

Fig. 4.—Eating fresh fruits and vegetables helps to clean and to improve the appearance of the teeth.

be eaten only at the termination of a satisfactory meal. Fourth, the frequency of eating is important. It is during the first hour or so after eating that bacteria form most acids, from foods adhering to the teeth. If one has frequent meals, eats sweets, drinks sodas, partakes of carbohydrate foods or chews gum containing sugar every waking hour, it is obvious that bacteria will be forming acid almost continuously and that, as a result, the teeth will be under continuous attack. If on the other hand, one eats only three

times a day, there will be only a few hours each day during which conditions conducive to tooth destruction will exist, and these hours, moreover, can be reduced to negligible periods if the teeth are cleaned or cleansing foods are eaten at the end of each meal.

These procedures, which are not really difficult to follow, will help materially in the prevention of dental decay. Only when the teeth are very poorly formed or when other abnormal conditions exist in the mouth are these measures liable to fail completely. Such eventualities cannot be guarded against entirely, but their importance can be reduced to a minimum by keeping in the best possible state of health. This requires care as to the adequacy of the diet in respect to vitamins, minerals and other food elements, and, equally important, it demands that attention be paid to the body's need for adequate hygienic care and rest. It is foolish to imagine that health will be restored by the addition of this or that substance to the diet if these other factors are neglected. Your physician and dentist should be relied upon for advice in this field and not your radio or newspaper.

The final and very important safeguard to which the teeth are entitled has already been indicated. It is that they be examined periodically so that small defects can be detected and remedied before they become too large. If the teeth are examined only when they give trouble, it is almost certain that the process of destruction will be well on its way. Therefore, your dentist should be visited periodically even though there is no reason to suspect any dental trouble. Such a habit will, in the long run, save trouble and expense and is an essential part of any preventive program.

RESEARCH COMMISSION

PHYSICAL PROPERTIES OF DENTAL MATERIALS

DENTISTS will be pleased to learn that National Bureau of Standards Circular 443, "Physical Properties of Dental Materials" by Souder and Paffenbarger, has been approved for a second printing, the first printing having been sold out within six months. The price is 75 cents. Orders should be sent to the Superintendent of Documents, Washington, D. C.

DANIEL F. LYNCH, *Secretary,*
Research Commission.

DENTAL RELIEF FUND COMMITTEE

The Dental Relief Fund Committee and the Officers of the American Dental Association wish to acknowledge publicly, the many letters and kind comments received with the contributions to the relief fund this year.

It is gratifying to know that more and more of our members are becoming actively interested; your encouragement and constructive criticism are very much appreciated.

In spite of the heavy increased demands, through taxes and charitable organizations, our contributions this year exceed those of last year, at this time.

Again, we wish to thank each and every one.

E. E. GRAHAM, *Secretary,*
Dental Relief Fund Committee.

COUNCIL ON DENTAL THERAPEUTICS

ACCEPTED DENTAL REMEDIES

The Council on Dental Therapeutics of the American Dental Association announces the inclusion of the following articles in the list of Accepted Dental Remedies.

ANESTHETICS—LOCAL*

Procaine HCl 2%, Epinephrine 1:50,000: Each cubic centimeter is stated to contain procaine hydrochloride, 0.02 gm.; sodium chloride, 0.002 gm.; sodium bisulfite, 0.0018 gm.; chlorobutanol (chloroform derivative), 0.005 gm.; epinephrine, 0.00002 gm.; in distilled water. Marketed in tubes, minimum capacity 2.2 cc.

Procaine HCl 2%, Epinephrine 1:25,000: Each cubic centimeter is stated to contain procaine hydrochloride, 0.02 gm.; sodium chloride, 0.002 gm.; sodium bisulfite, 0.0018 gm.; chlorobutanol (chloroform derivative), 0.005 gm.; epinephrine, 0.00004 gm.; in distilled water. Marketed in tubes, minimum capacity 2.2 cc.

Manufactured by Exodontia Products Co., Chicago, Ill. Distributed by the Kimball Dental Manufacturing Co., Chicago, Ill.

Procaine HCl 2%, Epinephrine 1:50,000: Each cubic centimeter is stated to contain procaine hydrochloride, 0.02 gm.; sodium chloride, 0.002 gm.; sodium bisulfite, 0.0018 gm.; chlorobutanol (chloroform derivative), 0.005 gm.; epinephrine, 0.00002 gm.; in distilled water. Marketed in tubes, minimum capacity 2.2 cc.

Procaine HCl 2%, Epinephrine 1:25,000: Each cubic centimeter is stated to contain procaine hydrochloride, 0.02 gm.; sodium chloride, 0.002 gm.; sodium bisulfite, 0.0018 gm.; chlorobutanol (chloroform derivative), 0.005 gm.; epinephrine, 0.00004 gm.; in distilled water. Marketed in tubes, minimum capacity 2.2 cc.

Procaine HCl 2%, Neo-Synephrine HCl 1:3500: Each cubic centimeter is stated to contain procaine hydrochloride, 0.02 gm.; sodium chloride, 0.002 gm.; sodium bisulfite, 0.0018 gm.; chlorobutanol (chloroform derivative), 0.005 gm.; neosynephrine hydrochloride, 0.000285 gm.; in distilled water. Marketed in tubes, minimum capacity 2.2 cc.

Manufactured by Exodontia Products Co., Chicago, Ill. Distributed by Bunny Dental Supply Co., Chicago, Ill.

DENTIFRICES†

Style King Tooth Paste: Composition: (See Sheffield Tooth Paste, A.D.R. Ed. 8, p. 113).

Manufactured by the Sheffield Company, New London, Conn. Distributed by Buchsbaum & Company, Chicago, Ill.

Admission of a product to the list of Accepted Dental Remedies does not imply a recommendation. It means that the product and the methods by which it was marketed at the time of consideration were not found to be in violation of the Council's published rules. Accepted products are reconsidered periodically. The files of the Council contain information on many drugs and dental cosmetics. All information is available upon request and inquiries are welcomed. A postal card will bring a prompt reply.

DONALD A. WALLACE, *Secretary.*

*A.D.R. Ed. 8, p. 38.
†A.D.R. Ed. 8, 102.

COMMITTEE ON LEGISLATION

VICTORY TAX

THE enactment of the Victory Tax affects the dental profession in two ways: first, every dentist is a taxpayer and, second, nearly every dentist is a tax collector. Simply stated, the Victory Tax is an additional income tax of 5 per cent on your net income in excess of your personal exemption of $624, and the payment of the tax on the income received during the year 1943 is due on March 15, 1944. The foregoing is a layman's statement of the tax as far as it affects dentists as taxpayers.

A novel and unique feature incorporated in the Victory Tax is known as the "pay-as-you-go" plan. Under this plan, certain employers are required to deduct 5 per cent of the wages and salaries in excess of certain amounts that are paid to certain employes. These amounts, called withholding deductions, over a period of a year amount to a total of $624, which is the employe's personal exemption, the exact figures being as follows:

Pay-roll period	Witholding deduction
Weekly	$ 12
Biweekly	24
Semimonthly	26
Monthly	52
Quarterly	156
Semiannually	312
Annually	624

Once every three months, the employer is required to turn the taxes collected from his employes over to the collector of internal revenue, using forms provided by the Bureau of Internal Revenue. The first return is due on or before April 30, 1943. There is a provision in the law requiring that each employer shall furnish to each employe a written statement showing the period covered by the statement, the wages paid by the employer to such employe during such period and the amount of the tax withheld and collected in respect of such wages, and that each such statement shall be in respect of his employment during the calendar year, and shall be furnished to each employe on or before January 31 of the succeeding year, or, if his employment is terminated before the close of such calendar year, on the day on which the last payment of wages is made.

Generally speaking, the term employer includes almost every employer, and the term employe includes every employe with the following exceptions: (1) members of the armed forces of the United States, (2) agricultural laborers, (3) domestic servants, (4) casual laborers not employed in the course of the employer's trade or business, (5) an employe of a non-resident alien, (6) an employe of a foreign government and (7) those having employment outside of the United States. Thus, the practical effect of the law is that as far as certain employes are concerned, the tax must be paid immediately at the time any wage or salary is received, and that as far as all others are concerned, including dentists, doctors, attorneys and all self-employed individuals, as well as those in the armed forces, agricultural laborers, domestic help, etc., the tax can be paid at the time that the regular income tax is paid; namely, March 15 following the year in which the income was received.

The Victory Tax is a tax on net income and provides for the usual and customary deductions from gross income in determining net income. These deductions are listed and explained in the law and they are as follows: expenses, interest, taxes, losses, bad debts, depreciation, depletion, pension trusts, net operating loss, amortization, alimony and special deductions. Generally speaking, these deductions are

defined in the same manner as they are now contained in the present income tax law.

There are two other unusual features in the tax called allowance of credit against the Victory Tax and the postwar credit, or refund of the Victory Tax. The law provides in effect that there shall be allowed as a credit against the Victory Tax for each taxable year the following amounts: (1) the amount paid by the taxpayer during the taxable year as a premium on life insurance in force on September 1, 1942 on the life of himself, his spouse, or a dependent, or any renewal or conversion of such insurance up to the amount of premiums payable September 1, 1942, (2) the amount by which the taxpayer has reduced his net indebtedness since September 1, 1942, and (3) the amount by which the taxpayer has increased his net total of certain United States bonds since December 31, 1942.

This credit can be taken at the time the tax is due, but is subject to a limitation that the amount of such credit must not exceed the postwar refund to which he is entitled, which is set up in another section of the law. This section provides that as soon as practicable after the cessation of the war, the following amount will be refunded immediately to the taxpayer, provided it has not previously been used as a credit toward his Victory Tax.

In the case of a single person or married person not living with husband or wife, 25 per cent of the Victory Tax or $500, whichever is the lesser. (2) In the case of the head of a family, 40 per cent of the Victory Tax or $1,000, whichever is the lesser. In the case of a married person living with husband or wife where separate returns are filed by each spouse, 40 per cent of the Victory Tax or $500 whichever is the lesser. In the case of a married person living with husband or wife filing a joint return under section 51(B), only one such credit shall be allowed and such credit shall not exceed 40 per cent of the Victory Tax or $1,000, whichever is the lesser. (3) For each dependent as defined in the law 2 per cent of the Victory Tax or $100 whichever is the lesser.

The law further provides that, on or before March 15 following each taxable year, each employe must render a final accounting to the government concerning his Victory Tax for the preceding year. In this accounting, he must show the total wages that he received during the year and, in addition thereto, any and all other income that he may have received from any source other than his wages or salary and his Victory Tax of 5 per cent must be paid on this additional income at that time. At that same time, he has the right to claim any of the deductions to which he might be entitled, such as business expenses that he has paid out of his own wages or salary and any of the other deductions specified above. At the same time, he has the right to claim credit for the amounts that he has paid on life insurance, reduction of indebtedness or government bonds, subject to the limitation shown above. Thus, on March 15, he may owe the government an additional Victory Tax over and above the amount deducted by his employer, or he may have a credit coming from the government which he can apply toward the payment of his other income taxes.

DEATH FROM DENTAL OPERATION AS CAUSED BY ACCIDENTAL MEANS WITHIN INSURANCE COVERAGE

By LESLIE CHILDS, Indianapolis, Ind.

WHETHER death resulting from a dental operation will constitute death by accidental means within insurance coverage has been litigated in a number of cases. And here we find the courts divided on two clearly defined lines of holdings. In short, in one line, it is held that when death is the unexpected or unforeseen result of an intentional operation, it is deemed to have been caused by accident; and this without proof of mischance, mishap or other unusual act which may have caused the fatality.

In the second line, it is not enough that the death was merely unexpected or unforeseen: it must appear that the means was accidental, or some mischance occurred in its application, to make the death one by accidental means. A great difference.

So much for the two rules. And now as an example of judicial reasoning in applying the first rule, the International Travelers Association *v.* Francis, 119 Tex. I, 23 S.W. 2d 282, will serve.

EXTRACTION-INFECTION-DEATH

The insured carried an insurance policy that covered death by "external, violent and accidental means." The insured had a tooth extracted and infection developed, which caused death from Ludwig's angina eight days later. Suit on the policy followed, with the insurance company denying liability on the grounds that the death did not result from external, violent and accidental means.

Upon the trial, it was in evidence that the dentist who extracted the tooth examined the insured before operating and found no trace of infection. The lower court found against the insurance company. On appeal, the higher court, in reviewing the record and in affirming the judgment, reasoned:

> There is no serious contention here but that the death of the insured was accidental; but the insistence is that the facts do not show that it was caused "solely and exclusively by external, violent and accidental means." In effect the insurance company here insists that there is a distinction between policies which insure against accidental death and those which insure against death by accidental means. . . .
>
> There can be no doubt but that the extraction of the tooth was the "*means*" of infection. This is so regardless of the question as to exactly how and when the pathogenic organisms entered the tissues—whether by contact with the surgical instruments and dressings, and thence into the lacerated tissues, or whether from some other attendant source.
>
> The fact is there was no infection until the flesh was lacerated by the pulling of the tooth, and the infection followed so closely that we cannot in a practical consideration of the subject separate the time of infection from the time of laceration; nor have the doctors attempted to do so, as shown by their testimony. . . . In fact, they regard the drawing of the tooth as the cause of the infection. If we consider the drawing of the tooth as the means of infection, then clearly that means was external, violent and accidental. . . . The judgment . . . is affirmed.

The foregoing constitutes a fair example of judicial reasoning in the line of cases holding that an unexpected fatal result from a dental operation will support a finding of death by accidental

means, even though there is no proof of mishap, mischance or other unusual factor in the death.

And now for the second line of holdings; i.e., those that require proof that the means employed was accidental, to support a finding that death from a dental operation was caused by accidental means. Here Adams *v.* the Metropolitan Life Insurance Co., 136 Pa. Sup. Ct., 454, 7 Atl. 2d 544, comes to hand.

FACTS IN THE CASE

In this case, the insured carried insurance policies that provided for certain extra payments for death by "external, violent and accidental means." The insured arranged with her dentist to have nineteen teeth extracted at one time. When the dentist had removed fourteen teeth in three minutes, as was planned, the insured died, while under the influence of the anesthetic.

Suit on the policy followed for the additional payment provided for death by external, violent and accidental means. The insurance company denied liability, taking the position that the circumstances of the insured's death did not fall within the coverage sought to be enforced. The lower court sustained this contention, and the higher court in affirming the judgment thereon, among other things, said:

> Evidence was offered showing that aside from the condition of her teeth, she [the insured] was in good health and had no known disease. It was neither shown nor suggested that there was any failure to exercise due care in the administration of the anesthetic or that there was any unusual happening or occurrence such as the slipping of an instrument or other unintended act. . . .
>
> In many jurisdictions, including the federal and our own state, a distinction is made between accidental injury and injury occasioned by accidental means. . . .
>
> Remembering that we are concerned with cause, not consequences, the plaintiff's own evidence shows conclusively that [the insured] arranged for the removal of nineteen teeth at one time while she was under the influence of an anesthetic and that fourteen of the teeth were removed by the dentist just as was planned. The dentist intended not only to remove nineteen teeth, but he designedly, not accidentally, removed fourteen in three minutes. . . .
>
> While the death was not expected by either the surgeon or the patient, every death or injury, though unexpected, may not be classed as an accident or said to be due to accidental means. More specifically, it is well settled that the mere fact that a surgical operation is followed by death is not sufficient to support an inference that death resulted from accidental means. . . .
>
> The distinction between accidental injury by accidental means becomes important here. . . . We are all of the opinion that the plaintiff did not bring himself within the provisions of the policies so as to justify a recovery. Judgment affirmed.

CONCLUSION

The foregoing cases constitute a fair presentation of the two lines of holdings on the question involved. In the first, we find that the unexpected, unforeseen death from a dental operation may be, in itself, sufficient to sustain a finding of death by accidental means. In the second, more is required; and there must appear proof of a mischance, mishap or accidental use of means, to sustain such a finding.

In the light of which, the outcome of a case of this character may depend not only on its facts and circumstances, but also on the jurisdiction in which it arises as well; and the authorities appear about equally divided between the two rules.

COMMITTEE ON ECONOMICS

MEETING OF INDUSTRIAL DENTISTS CALLED FOR FEBRUARY 22

THE Committee on Economics of the American Dental Association is issuing a final announcement of the meeting of industrial dentists to be held in Chicago February 22. It will be the purpose of this meeting to discuss the need for a permanent organization of men working in this field and to explore the possibilities of establishing such an organization. The meeting will be held at the Palmer House beginning at 10:00 a. m. The room number will be announced on the bulletin board in the lobby of the hotel.

Dental programs in industry are growing rapidly in importance. Interest in this type of dental practice is mounting. The rôle of this type of service in the maintenance of public health and the part that it can play in keeping war workers on the job in these crucial days are widely recognized. However, it is clear that before it can progress much farther, the industrial dental health program must somehow be coordinated and a channel of communication be set up to enable the men working in this field to keep in close touch with one another.

The United States Public Health Service has already done much to assist in the expansion and development of the industrial program through the appointment of some of their best men to work with problems in this field. Many of the directors of the dental divisions in the state departments of health are devoting a great deal of attention to the industrial problems. However, in order that the interests of public health may be properly served and that the rights and interests of the dental profession may be protected, it is essential that guidance and help be had from within the ranks of organized dentistry. No group is better qualified to perform this function than the men actually working in this field, the industrial dentists themselves. Without organization, the services of these men cannot be properly utilized. The entire body of organized dentistry, as well as the men actually working in the industrial field, would gain much from the formation of an organization of industrial dentists.

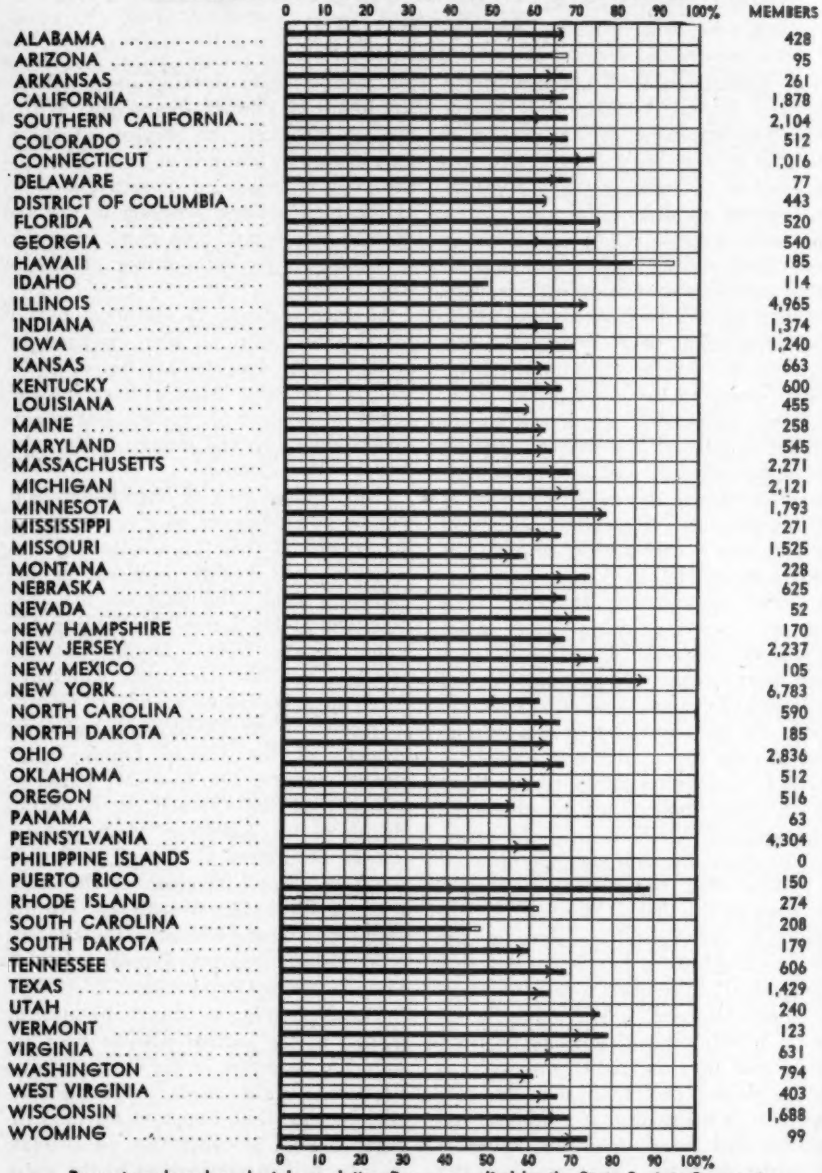
All men engaged in industrial dental practice and also all men engaged in public health dentistry are urged to attend this meeting. Men who are not engaged in this type of practice, but nevertheless have a special interest in the subject are also welcome.

Outstanding men in the dental field will be in attendance to give the group the benefit of their knowledge and experience with health problems in the industrial field. Included on the program will be Dr. James M. Dunning, Director of the Dental Division of the Metropolitan Life Insurance Company, Dr. Lyman D. Heacock and Dr. George L. Nevitt of the Division of Industrial Hygiene of the United States Public Health Service, Dr. Carl M. Peterson, secretary of the Council on Industrial Health of the American Medical Association, Dr. Powell C. Carrell of the Division of Dental Hygiene of the Connecticut State Department of Health, and Dr. Ernest Goldhorn, Dental Surgeon of the Pullman Standard Car & Manufacturing Corporation.

Those planning to attend the meeting should, at the earliest possible date, inform the Secretary of the Committee on Economics of the American Dental Association, 212 East Superior Street, Chicago, Illinois, in order that an estimate may be had in advance as to the number who will attend.

Membership Page

PERCENTAGE OF DUES RECEIVED IN CENTRAL OFFICE AS OF DECEMBER 31, 1942, AS COMPARED TO 1941 MEMBERSHIP



Percentage based on dental population figures supplied by the State Society Secretaries.

1942 percentage 1941 percentage

STATE SOCIETY OFFICERS' CONFERENCE POSTPONED

THE State Society Officers' Conference scheduled to be held in Chicago, February 21, 1943, has been postponed owing to travel conditions.

It is planned to hold this conference at the time of the House of Delegates meeting in Cincinnati next October.

HARRY B. PINNEY, *Secretary,*
American Dental Association,
212 East Superior St.,
Chicago, Ill.

JUNIOR MEMBERS AS OF DECEMBER 31, 1942

Atlanta Southern Dental College	72	Temple University	169
Baylor University	79	Texas Dental College	102
Chicago College of Dental Surgery	210	Tufts College	35
College of Physicians & Surgeons	116	University of Buffalo	61
Columbia University	153	University of Detroit	55
Creighton University	24	University of Illinois	61
Georgetown University	59	University of Louisville	132
Harvard University	10	University of Maryland	159
Indiana University	104	University of Michigan	42
Kansas City-Western Dental College	134	University of Minnesota	26
Loyola University	80	University of Nebraska	29
Marquette University	161	University of Pennsylvania	175
Medical College of Virginia	37	University of Pittsburgh	69
New York University	273	University of Southern California	172
North Pacific College of Oregon	172	University of Tennessee	8
Northwestern University	26	Washington University	26
Ohio State University	125	Western Reserve University	122
St. Louis University	16		
State University of Iowa	40	Total Junior Members	3,334

INTERNATIONAL ANESTHESIA RESEARCH SOCIETY

At the regular meeting of the board of governors of the International Anesthesia Research Society, November 15, 1942, the following motion was passed unanimously:

"Inasmuch as the two-thirds vote for the new constitution was not attained, as was specified necessary under the old constitution, the new constitution is thereby not in force and henceforth the society is working under the old constitution.

"According to the old constitution, the board of governors elected during an annual congress of anesthetists will serve until the next annual congress or until their successors have been elected. On this basis, the board of governors is continuing to serve until the next congress can be held. The 1942 congress was cancelled because of war conditions and another congress will be held at the earliest possible moment feasible."

The dental members of the International Anesthesia Research Society will remain voting members as in the past.

PAN AMERICAN RELATIONS COMMITTEE

DEPARTMENT OF STATE SUSPENDS, FOR THE DURATION, EXCHANGE FELLOWSHIP AND TRAVEL GRANT AWARDS TO UNITED STATES STUDENTS

THE Department of State announces that notes have been addressed by the Department to the diplomatic missions of the other American republics in Washington, informing them that the increasingly exigent demands of the war upon the manpower supply in the United States make it necessary for this government to suspend, for the duration of the war, the award of official scholarships, fellowships and travel or maintenance grants to students from the United States.

In transmitting this information to the diplomatic missions of the other American republics, the Secretary of State has informed them that the Government of the United States believes, as they are aware, that all the country's energies in human, material and spiritual resources must be directed solely toward the winning of the war. In practical terms, this means that most of the persons who would otherwise be eligible for appointment as exchange students or student travel grant recipients under Government programs will be engaged in the armed forces of the Nation, in the manufacture of war materials or in other activities closely related to the war effort.

Fellowships and student travel or maintenance grants awarded to citizens of the United States up to the date of the notification to the diplomatic missions will be honored, but no grants will be made after that date. They will, of course, be resumed as soon as feasible.

The Secretary of State has also emphasized that, in adopting this policy, the Government of the United States has no intention or thought of suspending or discontinuing the award of fellowships and travel and maintenance grants to citizens of the other American republics for study in the United States. On the contrary, he has expressed the hope that the situation in other American countries will permit the continuance of this program and that panels under the Convention for the Promotion of Inter-American Cultural Relations will be submitted by other participating countries in accordance with the standing procedure. He has added that the Department of State and other agencies in this Government will request funds for the 1944 fiscal year to continue this treaty arrangement, the award of travel and maintenance grants and similar activities such as the in-service training programs of certain government departments.

The Secretary of State recognizes in his communication to the diplomatic missions of the other American republics that it is undoubtedly desirable, for the future of inter-American and international relations, to build up as large a group as possible of well-trained people who are skilled in special technics and speak the languages of other American countries. He points out that, so far as the United States is concerned, many persons with special training are at present receiving experience in the other American republics through the Auxiliary Foreign Service and the foreign activities of the emergency economic and supplies agencies. It is the view of the Department that these persons will undoubtedly make an important contribution to inter-American understanding in their present positions and will furnish for the postwar period a body of well-informed persons in many technical and professional fields.

FIVE STATE POSTGRADUATE CLINIC

The Five State Postgraduate Clinic will be held in Washington, D. C., at the Mayflower Hotel, March 6 and 7.

The entire meeting will be devoted to scientific sessions and registered clinics.

The night of March 6, there will be a round table symposium on oral surgery. This promises to be an interesting discussion and most appropriate at this time. The group will include names of prominent surgeons in the east and those of the armed forces.

The last day will be given over to the armed forces, at which time moving pictures and clinics will reveal dentistry's outstanding accomplishments in the present war.

We urge all to take advantage of this opportunity to gather with us.

MARCUS N. PARKS, *Chairman,*
Publicity Committee,
1789 Columbia Road, N.W.,
Washington, D. C.

TRAINING OF DENTAL INTERNS HALTED BY ARMY DURING WAR

There will be no 1943 class of dental interns beginning their year of instruction next July and, for the duration of the war at least, this policy of giving interns a year of training before they are commissioned as first lieutenants in the regular army will be discontinued. The acceleration of the dental school program is the reason for this change. The graduates of 1943, instead of completing their courses next June, will finish them from three to six months earlier. A great majority of the senior students hold reserve commissions as second lieutenant in the Medical Administrative Corps of the Army or that of ensign in the Navy.

All graduates coming into the Army will be given a course of instruction. Some will be sent to hospitals and others to a pool, a replacement training center or to Carlisle Barracks, Pennsylvania. The duration of their training at these places will depend on the needs for dental officers in the field.

Eight Army Dental Corps officers on December 1 began a month's course of instruction in plastic surgery at the Army Dental School, Washington, D. C. The officers who will pursue this course of study, with stations indicated, include the following: Maj. George R. King, Fort Monmouth, N. J.; Maj. Leo Mackta, Fort Dix, N. J.; Capt. Abraham J. Corn, Camp Maxey, Texas; Capt. Daniel J. Holland, Jr., Camp Blanding, Fla.; Capt. Karl F. Ehrlich, Fort Bragg, N. C.; Capt. Francis A. Holland, Nashville, Tenn.; Lieut. Ick T. Imhoff, Fort Devens, Mass., and Lt. Wilfried M. LaBelle, Indiantown Gap, Pa. First Lieut. Lloyd G. Welty, Letterman General Hospital, California, has been promoted to captain.

CORRESPONDENCE

"EVALUATION OF ACRYLICS FOR MASTICATORY-SURFACE RESTORATIONS"

To the Editor:

IN an article by Jacob A. Saffir, in the December 1942 issue of THE JOURNAL, the following statement was made, "In a table on the safe operating temperatures for plastics, the Boonton Manual gives the low temperature for acrylate as 120° F. It is known that food as hot as 122° F. is not unusual."

In other words, dentists are made to believe that methyl methacrylate will be so softened by foods whose temperature reaches 120°F. that it will actually flow in the mouth. I am not biased one way or the other regarding this material and would be the first to contend that if such were the case, the fact should be published so that the profession will not be misled into using inferior materials. However, I have read a report published by the Research Associates (W. T. Sweeney, G. C. Paffenbarger and John R. Beall) of the American Dental Association under the auspices of the National Bureau of Standards, in the January 1942 issue of THE JOURNAL, from which I quote the following, "Methyl methacrylate resin has the highest softening range of the resins and in this it, therefore, has a distinct advantage."

Even rubber, the article states, has an intermediate softening range between the low of the cellulose nitrate compounds and the high of methyl methacrylate. I for one have never seen a rubber denture flow in the mouth under normal conditions and fail to see why methyl methacrylate is permitted to be so maligned by Dr. Saffir.

It probably is true, as the Boonton Manual states, that some acrylates do flow at 120° F., but members of the dental profession are at present interested for the most part in methyl methacrylate, which has a much higher softening range.

I also wish to quote the following data from a book entitled "Science of Dental Materials," by Eugene W. Skinner, Ph.D., associate professor in physics in the Northwestern University Dental School. This book was published by the W. B. Saunders Co. in 1940. On page 93 is the following regarding methyl methacrylate, "The resin is extremely stable. It will not discolor in light and has excellent aging properties. It is remarkably stable to heat. It will soften at 125° C. or 257° F. but it will not decompose or discolor at temperatures up to 200° C. or 392° F."

From a book just published by Maurice N. Stern, entitled "Enameloid Acrylics in Dentistry," page 14, under the heading "Thermal Effects," I quote the following, "The processed material softens at 257° F. As this is in excess of any mouth condition, it need only be remembered during grinding and finishing."

I believe that material should be "scientifically" judged and evaluated by such experts as those whom I have quoted in this letter to you. It is harmful and many times disastrous to permit unscientific data to be published in THE JOURNAL. The profession naturally relies on the American Dental Association and takes it for granted that what is published is the scientific truth.

I am not an expert on this material; in fact, I have used very little of it, but I felt that Dr. Saffir's article was misleading and would prevent many dentists from even giving this material a just and fair trial.

ARTHUR A. SCHWEITZER, D.D.S.,
324 Madison Ave., New York, N. Y.

DEATHS

EBERLE, EDGAR H., Cincinnati, Ohio; Ohio College of Dental Surgery, 1903; died August 29; aged 61.

FISHER, J. MORTON, Calumet, Mich.; University of Michigan School of Dentistry, 1930; died July 30; aged 40.

FRANKEL, HENRY, Chicago, Ill.; University of Illinois College of Dentistry, 1901; died September 18; aged 73.

FRASIER, JOHN W., Cleveland, Ohio; Western Reserve University School of Dentistry, 1904; died October 7.

GREENHOW, BARNEY F., Peoria, Ill.; Northwestern University Dental School, 1889; died October 5.

GROSSMAN, WALTER F., Cincinnati, Ohio; Cincinnati College of Dental Surgery, 1908; died July 12; aged 63.

HARE, EDWIN C., Berwyn, Ill.; University of Illinois College of Dentistry, 1914; died September 29; aged 50.

HERRON, HAROLD M., Lansing, Mich.; University of Michigan School of Dentistry, 1898; died August 26; aged 64.

JEWELL, HERMAN A., Cincinnati, Ohio; Cincinnati College of Dental Surgery, 1924; died June 29; aged 45.

KEMP, SHELDON R., Captain, U. S. Army; formerly of What Cheer, Iowa; State University of Iowa College of Dentistry, 1933; died August 5 of a heart attack; aged 34.

KING, FRANK, Rolfe, Iowa; Chicago College of Dental Surgery, 1892; died August 1; aged 84.

KNECHT, FREDERICK, Chicago, Ill.; Northwestern University Dental School, 1905; died June 27; aged 72.

KUESTER, WILLIAM, Chicago, Ill.; Chicago College of Dental Surgery, 1888; died September 23; aged 77.

KULANDER, HENRY, Minneapolis, Minn., formerly of Swea City, Iowa; Keokuk Dental College, 1904; died August 30; aged 70.

LA BARGE, EDMUND J., Cleveland, Ohio; Western Reserve University School of Dentistry, 1907; died October 2; aged 57.

LAPPIN, MANLY ROBERT, Riceville, Iowa; Chicago College of Dental Surgery, 1905; died August 25; aged 63.

LARKOWSKI, FLORENCE, Chicago, Ill.; Northwestern University Dental School, 1930; died October 1; aged 33.

LAZEAR, WILLIAM W., Winnetka, Ill.; Philadelphia Dental College, 1882; died March 22; aged 86.

LUMMIS, HERBERT W., Cape May City, N. J.; University of Pennsylvania School of Dentistry, 1902; died July 2.

LYNCH, FRANCIS L., Des Moines, Iowa; State University of Iowa College of Dentistry, 1911; died August 19; aged 54.

MCCLELLAN, ANDREW J., Detroit, Mich,; University of Michigan School of Dentistry, 1916; died July 15; aged 56.

MAJOR, S. GLENN, Pittsburgh, Pa.; University of Pittsburgh School of Dentistry, 1921; died October 14; aged 42.

PALMER, CHARLES M., Charles City, Iowa; Kansas City Dental College, 1895; died September 13; aged 78.

RICHARDSON, PERLY H., Erie, Pa.; University of Pittsburgh, School of Dentistry, 1917; died September 26; aged 49.

ROZIER, R. A., Marianna, Fla.; Atlanta Dental College, 1897; died August 29; aged 72.

SCHWIN, FREDERICK W., Red Lodge, Mont.; State University of Iowa College of Dentistry, 1906; died September 27; aged 61.

SMITH, PERRY L., DeKalb, Ill.; Northwestern University Dental School, 1903; died September 20; aged 58.

SPOON, JOHN EDWARD, San Jose, Calif.; University of California, College of Dentistry, 1928; died August 29; aged 41.

VONDERHEYDT, HARRY, Chicago, Ill.; University of Illinois College of Dentistry, 1908; died October 5.

WARNER, MAHLON W., Parkersburg, Iowa; State University of Iowa School of Dentistry, 1892; died September 28; aged 77.

WEILER, ALBERT S., Cleveland, Ohio; Ohio College of Dental Surgery, 1891; died September 9; aged 70.

WHEELER, DAVID P., Madison, Wis.; Chicago College of Dental Surgery, 1902; died September 23; aged 64.

WILLIAMS, R. RALPH, Chicago, Ill.; Northwestern University Dental School, 1923; died October 8; aged 46.

WRIGHT, JAMES E., Des Moines, Iowa; State University of Iowa College of Dentistry, 1917; died September 18; aged 47.

ZUN, JACOB, Chicago, Ill.; Chicago College of Dental Surgery, 1915; died October 9; aged 53.

INCIDENTS OF PRACTICE

Supernumerary Tooth

By Nathan Peck, D.D.S., Bronx, New York, N. Y.

In the December issue of The Journal, Martin T. Siegel submitted an x-ray film of a supernumerary tooth between the first incisors in a child of 6 years.

I am enclosing an x-ray film of a case of mine showing a similar condition in an adult, aged 26. It will be noted that

Supernumerary tooth between central incisors.

the supernumerary tooth has a well-formed root and is firmly anchored in bone.

I should appreciate some advice from Journal readers relative to treatment of the case. It seems to me that the extraction of a supernumerary tooth would not improve the appearance of the patient since the space is too small for a fixed bridge.

4197 Park Avenue.

Supernumerary Teeth

By J. L. Vize,* D.D.S., St. Louis, Mo.

Herewith is a roentgenogram of two supernumerary teeth between the two upper central incisors, the left supernumerary completely inverted, in a boy 11 years of age. The case was referred to the exodontia and oral surgery unit of the St. Louis Municipal Dental Clinics

Supernumerary teeth between upper central incisors.

by A. V. Bauer, who is in charge of one of the out clinics.

The unusual space between the two central incisors seems a striking example of how normal teeth can be pushed out of their natural positions by supernumerary teeth.

*Assistant superyisor of the Municipal Dental Clinics.

Protecting an Opened Maxillary Sinus

By Herl L. Crowthers, D.D.S., Los Angeles, Calif.

The floor of the maxillary sinus will occasionally be found to dip so low as to involve the roots of the upper first molar. When this condition is present, it is

Gauze canopy in place.

sometimes impossible to remove a tooth from the antrum in one piece without bringing the involved portion of the

antral floor with it, thereby creating an accidental opening into the oral cavity.

If, for any reason, such an opening is made, it will be found expedient and helpful to suture a piece of iodoform gauze of suitable size over the orifice, as illustrated, after the socket has been treated.

The gauze canopy will serve as a support for the blood clot as it forms; prevent contamination, by mouth fluids, etc., etc., of the sinus cavity, and materially aid in healing.

The canopy may be left in place for three or four days if necessary or be replaced as desired.

Roosevelt Building.

Darkening of Acrylic Restorations

By VINCENT M. JOHNSON,* A.B., D.D.S., Chicago, Ill.

FOR some time, men in the dental field have been complaining about the dark color which acrylic inlays, crowns and bridges attain after being in the mouth

Appearance of the teeth of a patient before treatment for discoloration.

certain periods of time. This color ranges from a dark gray to black, and is usually a deeper shade at the margins of the prostheses.

Since acrylics possess a degree of translucency, a dark cement would cause the prosthesis to appear inharmonious in the mouth. However, if it is removed and the cement cleaned from its surface, it will again be of the proper color.

*Instructor in pedodontia at Northwestern University Dental School.

This type of discoloration is not to be considered here. The present investigation dealt with acrylic prostheses which, when placed in the mouth, were esthetically fine for as long as three weeks, and then started to darken.

These darkened prostheses were removed from the mouth and maintained their dark shade after the cement had been removed. Slicing and crushing of these acrylics showed that the dark shade was throughout, evidence that it was not a surface discoloration as at first believed.

The darkened acrylics were placed in many reagents without evidence of any change in color. Finally, aqua regia was used, and the discoloration disappeared within three minutes.

Since the presence of a sulfide was suspected, the acrylic prostheses were placed in ammonium polysulfide, and the dark color again appeared, in less than one hour.

An Anomalous Central Incisor

By A. C. MACDONALD,* and W. J. SIMON,† Minneapolis, Minn.

SEPTEMBER 2, 1942, a man, aged 29, came to the Station Hospital Dental Clinic at Fort Snelling, Minn., with a fractured incisor. While on furlough in his native state, he had become engaged in a fight, apparently not sparing brass knuckles, and had had the mesio-incisal angle of the upper right central incisor broken off, as indicated by the arrow in Figure 1.

Close scrutiny of this tooth revealed an anomalous central incisor of no mean dimensions. Figure 2, an occlusal aspect of a cast of the premaxilla, shows the width of the right central incisor as compared with the left. Factually, the mesiodistal diameter of the right is 12.9 mm. and the left 9.4 mm. In spite of the fact that there is a diastema on the mesial and on the distal side of the left central

*Major (DC), AUS.

†First lieutenant (DC), AUS.

incisor, there is also a left cuspid; whereas, in the right upper quadrant, no cuspid is present and the anomalous central is in contact with the right lateral incisor.

Anatomically, the anomalous central incisor is similar to the bilateral complement except in size. Both have a deep lingual fossa, accentuated by well-developed marginal ridges folding into a lingual groove over the cingulum. While it is possible to suspect a state of fusion of a central incisor and cuspid to form this anomalous tooth, it is interesting to note that the anomalous tooth consists of three marked developmental lobes, which are well defined by the developmental grooves.

Fig. 1.—Cast showing fractured central incisor.

Fig. 2.—Occlusal aspect of cast, in Figure 1, showing difference in width of central incisors.

The roentgenogram of the anomaly is shown in Figure 3. One single root with a very large chamber and canal is present. Though the root is large in circumference, there is no significant difference in length as compared with the adjacent normal central incisor.

Perhaps the most interesting part of the case is that while the patient was disturbed about the chipped mesio-incisal angle, he was not aware of the fact that he possessed an enormously large tooth or that he was congenitally lacking a cuspid.

Fig. 3.—Roentgeographic appearance of anomalous central incisor.

The patient is normal in all other respects, weighs 165 pounds and is 5 feet 11 inches tall. He has four brothers and two sisters and, as far as he knows, they have never shown anything abnormal regarding their teeth.

CURRENT LITERATURE

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The "Vitality" of the Calcified Dental Tissues. V. Protective Metamorphosis in the Dentin

PROTECTIVE metamorphosis has been described as a modification of the dentin as a result of the aging process. It can only be observed by the examination of ground sections. Histologically, one may observe diminution or arrest of the diffusion of dental lymph. This process increases the immunity of teeth to dental caries. An examination of 106 selected teeth shows that protective metamorphosis progresses from the crown to the apex of the tooth. The coronal dentin exhibits the change from fifteen to nineteen years after eruption. In the cervical third of the root, it occurs at from about 25 to 29 years of age and about five years later in the middle third. Protective metamorphosis was found to occur on crowned teeth in which the enamel was not removed and also in unerupted teeth. Preliminary examination of devitalized teeth demonstrates that the aging process of dentin is arrested, with loss of vitality of the tooth.

Failure to Produce Dental Caries by Disturbance of Acid-Base Balance

EXPERIMENTS were performed on three litters of albino rats (nine, nine and six rats in a litter) by means of daily subcutaneous injections of solutions as follows: Six rats received 2 cc. of sodium bicarbonate (3 per cent) daily, two of them for seventy-seven days, four for 112 days. Ten rats received alternate daily injections of 2 cc. of sodium bicarbonate (3 per cent) and 2 cc. of ammonium chloride (1.5 per cent), each animal receiving from thirty-eight to fifty-four injections of sodium bicarbonate and from forty-one to sixty injections of ammonium chloride. Eight rats (one-third of each litter) served as controls and were not given injections. The animals were kept on a diet, in the form of fine particles, containing the ingredients necessary for normal growth and development, to prevent caries as a result of fracture lesions of enamel. By cardiocentesis, blood was obtained, to ascertain whether injected solutions were effecting any noticeable alteration in the carbon dioxide content of the blood in experimental animals. Although the results indicate that the presence of sodium bicarbonate raised the carbon dioxide content of the blood, and that of ammonium chloride lowered it, these findings are based on so few determinations that no conclusions can be drawn from them. The carbon dioxide content was higher in every case when the animal was etherized. The

*Titles marked with an asterisk are abstracted herewith.

results do not agree with those of Forshufvud, who asserted that such daily disturbance of the acid-base equilibrium caused rampant caries in rats. The authors saw caries in only one case, that of a control animal.

The Measurement and Comparison of Dental Caries Experience

DENTAL caries experience rates representing probabilities may be directly compared with the rates used in ordinary methods. The dental caries experience rate, number of decayed, missing and filled permanent teeth per hundred persons examined, on the other hand, involves multiple events. To compare rates of this kind requires knowledge of the frequency distributions yielding the rates. A procedure of comparison involves the chi-square test.

Acid Production of Oral Bacteria Associated with Dental Caries

In a test to determine the acidogenic and aciduric properties of thirty strains each of oral lactobacilli, streptococci, staphylococci and yeastlike organisms, all strains produced a terminal pH of 5 or less in glucose broth, but the lactobacilli alone lowered the hydrogen-ion concentration markedly below this level. On the basis of subculture, after ten days in glucose broth, all except the streptococci could be considered aciduric. Only two of the thirty strains were capable of being subcultured at the end of this period. In bromcresol green-dextrose-agar (pH 4.75), neither the streptococci nor yeast alone or in combination changed the color in four days. A few strains of staphylococci gave positive reactions in forty-eight hours. However, twenty-nine of the thirty strains of lactobacilli turned the medium in twenty-four hours or less. Symbiotic mixtures gave no indication of increased acid production under the conditions of the experiment.

Nutritional Requirements of Oral Lactobacilli I. Pantothenic Acid and Dextrose (d-Glucose)

THIS investigation consists of observations of growth response of oral lactobacilli to increments of pantothenic acid and dextrose, which were made in an attempt to evaluate the nutritional requirements of the common types of acidophilus found in the mouth and the presence of these substances in the saliva. Typical colonies of oral lactobacilli were established from growth on a peptone-tomato juice-agar medium. A pantothenic acid-free medium, as described by Pennington, Sneli and Williams, was used in this study. Washed strains of selected types of lactobacilli were used as the inoculum and the multiplication of these organisms was measured by the titratable acid produced. Graphs showing the actual titration readings obtained after incubation for seventy-two hours illustrate the growth response to increments of calcium pantothenate and dextrose. Conclusions: 1. Pantothenic acid is a requirement for growth of oral lactobacilli. 2. Pantothenic acid is present in human saliva. 3. The optimal quantity of pantothenic acid for oral lactobacilli growth is not greater than usually found in human saliva. 4. Dextrose is a requirement for growth of oral lactobacilli. 5. Dextrose 1.5 mg. per cubic centimeter of medium is an adequate amount for maximum growth of oral lactobacilli. 6. The pantothenic acid and dextrose requirements for maximum growth of oral lactobacilli vary for different types and strains.

Tissue Reactions in Experimental Tooth Fracture

TISSUE reactions of the teeth and surrounding tissues were studied in the jaws of young dogs in which fractures of the teeth had been experimentally produced. Reactions observed in sectioned material reveals that coronal fractures are more susceptible to inflammation and necrosis than those occurring in the apical region of the tooth.

Fractures located well below the epithelial attachment are restored to functional adaptation to the greatest extent when the fragments are in apposition and in alinement, to a lesser degree when the fragments overlap and least of all when the fragments are widely separated. In general, apical fractures that reveal no pathosis tend to functional repair, first a fibrous union, later a partially calcified callus-like union.

In the coronal region of the tooth, inflammatory reactions associated with fracture may cause destruction of the epithelial attachment. Pulp capping also may occur in this region.

Influence of Loss of Permanent First Molar on Position of Eruption of Second Premolar

AN examination was made of boys and girls aged 15 to 19 years, inclusive, pupils of the vocational high schools in the City of New York, who had lost one or more permanent first molar teeth and in whom the space left by the extraction was subsequently eliminated by the shifting of the adjacent teeth.

When the space left by the extraction of maxillary first molar teeth was entirely eliminated, there was no correlation found between the amount of distal shifting of the premolar teeth in the maxilla and the age of the child when the first molar extraction occurred. There was no increase shown in the amount of space between the first and second premolars in the maxilla with the increase of the time interval since extraction of the first molar.

In the mandible, the amount of distal shifting of the second premolar teeth and the amount of space between the premolars shows a direct correlation to the age of the child when the first molar was extracted, in spite of the fact that the space left by the extraction of the first molars was closed in all cases. The younger the child, the greater the space between the first and second premolar teeth. It is suggested that this is due to the eruption of the second molar by way of the first molar space when the first molar is extracted before the second premolar has erupted.

Dental Health Education in Illinois

By LLOYD H. DODD

A REPORT is made of one year's activities of the Committee on Dental Health Education of the Illinois State Dental Society, also its relations with the Division of Dental Health Education, Illinois State Department of Health.

In view of the large percentage of young men deferred or rejected under Selective Service examinations because of dental deficiencies, the importance of dental health education becomes increasingly evident and this report summarizes the work accomplished in Illinois, new programs adopted including a restorative program for the underprivileged preschool child and the mothers, new dental health programs, industrial hygiene, civilian defense, Selective Service dental examination work sheets for the use of dentists on local draft boards, and a program for teachers' colleges, dental schools and the Illinois Congress of Parents and Teachers.

An interesting feature includes a report from the Division of Dental Health Education, State Department of Health of follow-up findings for a period of five years. This covered 246,292 children, of whom 20 per cent did not need dental attention, and 43.2 per cent had received professional attention. These reports, coupled with the findings of school dentists in Illinois, lead to the conclusion that the dental health program throughout the state is sound and that results are excellent.—*Illinois D. J.*, 11:405-407, September 1942.

Effect of Relative Humidity on the Setting Time of Plaster of Paris.

By G. J. FARMER and E. W. SKINNER

THE initial setting time of plaster of Paris as determined with the Gillmore needle has been tested under conditions of varying relative humidity. Slight changes in setting time were observed after a storage time of six weeks below a relative humidity of 70 per cent, which may explain the erratic setting times of plaster often observed in practice. Storage at any relative humidity above 70 per cent caused an impractically long setting time.

Consecutive observations of plaster stored at 100 per cent relative humidity at first showed progressively lower setting times, but, at any rate after seventy hours, the setting time increased greatly, as before. Such data indicate, first, a partial hydration of the plaster, the resultant formation of nuclei of gypsum decreasing the setting time. Later, the plaster particles become coated with gypsum and thus the reaction is delayed.—*Northwest. Univ. D. Grad. Bull.*, 43:12-16, December 7, 1942.

Pharmacology in Its Relation to Dentistry

By JOHN A. HIGGINS

IN this article, the author decries a lack of interest in pharmacology on the part of den-

tists. He maintains that a higher level of teaching this subject would increase the interest and result in a more productive knowledge of pharmacology. The teaching of pharmacology in dental colleges is of a mediocre type, the subject, in reality, being mostly absorbed in the subject of physiology.

To date, the use of drugs, in the hands of dentists, is based mainly on past experiences, with little if any consideration of rational scientific explanations. Thus, pharmacology, among the dentists, is treated as an empiric art instead of being awarded its rightful place as an applied science.

Feelings of indifference only lend support to the assertion that dentistry is based upon ingenuity of a mechanical sort. The possession and the use of mechanical devices do not constitute general scientific advancement or achievement. In summary, the author refers to the expression of Glupker, who states that "as a general rule, we dislike that which we lack knowledge of or have not learned to achieve."—*Illinois D. J.*, 11:490, November 1942.

Comparison of Caries Incidence, Salivary Quantitative Counts and Salivary Enamel Solubility

By MELVIN E. SCHAINIS

ON the basis of the study of fifty persons, there is a definite correlation of the clinical condition, as determined by instrumental and bitewing film examinations, and the results of salivary tests. The two tests used were the quantitative salivary *Lactobacillus acidophilus* counts as described by Crowley and Jay and the determination of the amount of calcium dissolved in saliva-sugar-enamel mixtures during four hours of incubation at body temperature as proposed by Fosdick and his associates. There was a close correlation between the clinical condition and the chemical test in 90 per cent of the cases examined and a correlation of 66 per cent betwen the acidophilus count and the clinical state. It is concluded that these tests are reliable up to between 80 and 90 per cent, nearer 90 per cent in the case of the chemical test and close to 85 per cent with the bacteriologic test. The two tests were in close correlation with each other in 80 per cent of the cases examined, and in only five instances (ten per cent) was there a complete disagreement between the results of the two tests.—*Northwest. Univ. D. Grad. Bull.*, 43:17-22, December 7, 1942.

Histological Study of Bone Healing in Relation to the Extraction of Teeth

By ROBERT F. CHRISTOPHER

IN this study of the healing of extraction wounds, human material was used. The mucoperiosteal flap was laid back and two parallel cuts longitudinal to the socket were made with a three-quarter inch lightning disk. These cuts extended through its labial bone to the bone on the lingual wall of the socket and permitted the removal of a block of tissue containing the labial plate and socket content, for microscopic examination. With this material, normal and abnormal tooth socket healing was studied.

The normal healing was found to follow that which has been reported to take place in dogs, but at about half the rate. The sections made to study abnormal healing showed a layer of dead bone lining the socket. The process of repair seemed to start behind and to break through this wall of dead bone. The socket was filled with the granulation tissue of repair and there was final destruction by the osteoclastic action of particles of dead bone left in the area. —*Northwest. Univ. D. Grad. Bull.*, 43:5-11, December 7, 1942.

Treatment of Vincent's Ulceration of the Mouth and Vincent's Angina

By E. V. TOMEY

LOCAL treatment alone is insufficient to cure Vincent's infection. In addition to prescribing a mouthwash, keeping the mouth clean and painting the affected tissues with tincture of iodine, sodium perborate or dilute chromic acid, or packing them with oil of cloves, the dentist must prescribe a fresh fruit dietary containing large supplements of vitamins C and D, halibut liver oil, nicotinic acid and riboflavin. It is dangerous to extract roots or scale the teeth until the ulceration is controlled. A chlorate-perchlorate prescription is recommended as essential in treatment of ordinary cases; sulfanilamide in severe cases. Precautions should be taken to avoid spread of the disease to other parts of the body or to other persons. A nascent iodine treatment, not for use more than three times a week, is de-

scribed. The schedule of treatment given is said to effect a definite cure of severe cases in five to ten days.—*S. Afr. D. J.*, 16:327, October 1942.

H. B. McCAULEY.

Chronic Fluorine Poisoning (Fluorosis)—Signs and Symptoms

By LEO SPIRA

SURVEY of a great number of men and women in Great Britain revealed that 21.9 per cent of those examined had mottled enamel. Interrogation of 1,099 individuals further showed that the following symptoms and signs coexisted with mottling of the teeth: constipation, in 49 per cent; paresthesia, in 34.5 per cent; furunculosis, in 29.5 per cent; urticaria or other dermatoses, in 29 per cent; dhobie itch, in 18.5 per cent; alopecia, in 28.8 per cent, and brittleness of the nails, in 16.8 per cent. Only 11.4 per cent exhibited none of these signs or symptoms. These findings appear to substantiate the claim that the ingestion of fluorine affects the parathyroid glands.—*Edinburgh M. J.*, 49:707, November 1942.

H. B. McCAULEY.

Carcinomatous Change in Mixed Salivary Gland Tumors

By RUPERT V. HUDSON

Although adenocarcinoma and squamous-cell carcinoma of the salivary glands have been recognized, it has not been proved that they have ever arisen from a tumor of the "mixed" type. In the two cases reviewed, salivary gland tumors of the mixed parotid type were established as the source of an undifferentiated spheroidal cell carcinoma.—*Brit. J. Surg.*, 30:175, October 1942.

H. B. McCAULEY.

Massive Mixed Tumor of the Submaxillary Gland

By HARWELL WILSON

THE salivary glands may be associated with three types of epithelial growths: mixed tumors, carcinomas and, rarely, true adenomas. A mixed tumor of the submaxillary gland is comparable with that of the parotid histologically and clinically, although it occurs much less frequently. The epithelial elements may assume the form of alvéoli, cell strands or diffuse masses. The mesoblastic material consists chiefly of fine connective and mucous tissue, often containing cartilage. Such tumors may occur outside the conventional locations and are found in the floor of the mouth, in the retropharyngeal region and in the lateral walls of the neck. They are often operable under local anesthesia and do not recur unless incompletely removed.—*Am. J. Surg.*, (N. S.), 58:426, December 1942.

H. B. McCAULEY.

External Drainage in the Treatment of Fractured Mandibles

By MARTIN A. RUSHTON

COMPOUND fractures of the mandible should be treated by extra-oral incision and drainage in (1) all cases having an external communicating wound, (2) those cases involving infection of the fracture hematoma, (3) those cases in which a large hematoma, collection of pus or a sequestrum exists below the fracture line and (4) late cases characterized by progressive bone loss. Examples of treatment are given in four case histories.—*Brit. D. J.*, 73:283, December 4, 1942.

H. B. McCAULEY.

Arteriovenous Angioma of the Mandible and Retina with Pronounced Hematemesis and Epistaxis

By L. S. BOWER et al.

A BOY, aged 9, admitted to Cook County Hospital, Chicago, for treatment of profuse epistaxis and hematemesis, gave the impression of having a blood dyscrasia. The temperature was 102.8° F.; pulse, 110, respiration, 22; blood pressure, 90 systolic, 50, diastolic; hemoglobin, 43 per cent, white blood count, 7,450, and red blood count, 2,440,000. Two days after admission, pain in the left jaw drew attention to large cystic areas visible in roentgenograms and apparently infected. Blood was seen to flow from around the left first permanent molar, which was loose. This tooth was extracted. There was an elevation of temperature two days later, and reexamination revealed infection of the lower incisors. Institution of drainage cleared up the condition. Nine months later, no roentgenologic evidence of the cystic areas could be found. Nose-

bleed was found to be the probable result of an angioma of the left fundus containing both arterial and venous elements anastomosed in such a way as to preclude the normal flow of blood through a capillary network. The necessity for examination of the jaws and teeth for obscure causes of epistaxis or hematemesis is emphasized.—*Am. J. Dis. Child.*, 64:1023, December 1942.

H. B. MCCAULEY.

Oral Manifestations of Occupational Origin

By ISAAC SCHOUR and B. G. SARNAT

BASICALLY, occupational disturbances in the oral cavity are reactions to noxious agents, chemical, physical or bacterial, acting locally or systemically. The end-result may take one or more of the following forms: abrasion, decalcification or caries of the teeth, pigmentation of the gingiva or the enamel, circulatory disturbance, inflammation, degeneration or tumor. Abrasions of the teeth are common among seamstresses, carpenters, shoemakers, upholsterers, glassblowers, cement workers and players of wind instruments. Munition workers exposed to acids often show decalcification of the teeth; metal workers (from metal dust), enamel pigmentation. Persons exposed to the heavy metals, such as lead, bismuth and mercury, may inhale them, with pigmentation of the gingiva resulting. This line should not be confused with the cyanotic tinge of marginal suppurative gingivitis. The importance of oral hygiene in alleviating possible poisoning from mercury, phosphorus or radioactive material is emphasized. Gingival hemorrhage and ulceration and necrosis of the mandible have been reported among those exposed to benzene, such as coke oven and smokeless powder workers. Improved working conditions and the maintenance of optimal oral and general health are necessary to reduce oral occupational disease.—*J.A.M.A.*, 120:1197, December 12, 1942.

H. B. MCCAULEY.

Effects of Thyroidectomy on the Skull of the Domestic Rabbit

By MARTHA W. HUNTER and P. B. SOWIN

THE skulls, teeth and jaws of eighty-seven growing rabbits were studied to determine the effects of cretinism. Differential degrees of retardation in proportion to the rate of growth were found in the face and jaws of thyroidectomized animals. The phenomenon appeared more marked in the female than in the male. A tendency to provide for normal development of the dentition, eyes, brain and respiratory function was seen in a compensatory vertical expansion of the posterior facial bones. The upper and lower jaws of the cretins were distinctly spongy, deformed and underdeveloped. The teeth themselves appeared to be essentially normal as to time of eruption, size, form and development, though they often exhibited hypercurvature and protrusion of the roots through the floor of the orbit or lower border of the mandible. The alveolar crests in the cretinized jaws were irregular and the teeth arranged abnormally and asymmetrically. The incisor teeth were worn at right angles to their long axes instead of being beveled obliquely. Most of the anomalies found are probably attributable to a general lowering of physiologic activity, a restriction in the internal resorption of bone (smaller than normal foramina) and slow growth of the jaws coincidental with normal growth and development of the teeth.—*Am. J. Anat.*, 71:417, November 16, 1942.

H. B. MCCAULEY.

Spondylosis Deformans in Relation to Fluorine and General Nutrition

By F. H. KEMP, M. MURRAY and D. D. WILSON

A ROENTGENOLOGIC investigation was made of twenty-seven people (five adults and twenty-two children) to determine whether mottling of enamel due to fluorine ingestion was associated with skeletal changes. Findings suggested that disturbances of ossification were fairly common among children, but fluorine ingestion could not be held responsible, although two cases showing severe skeletal changes were associated with dental fluorosis, and six children from Maldon in Essex with markedly mottled enamel exhibited disturbance of ossification. Signs of similar developmental disturbances and early spondylosis deformans were found among many young adults, in some of whom dental fluorosis was also noted. The findings are in accord with clinical experience which suggests that spondylosis deformans is the result of progressive degeneration of malforma-

tion arising in youth. The presence of fluorine in the soil and water, in association with defective nutrition, may favor such maldevelopment.—*Lancet*, 2:93, July 25, 1942.

PETER P. DALE.

Calculus in Wharton's Duct

By W. C. MELLOR

A WOMAN, aged 64, had the remaining lower six anterior teeth extracted and had a denture inserted one month later. She complained of pain from the denture on the lingual side of the left ridge, which was relieved by removal of the corresponding flange of the denture. After a week, the patient returned for observation. She stated that the denture was comfortable, but that the previous site of pain presented an asymptomatic lump. Palpation revealed a hard rounded swelling sublingually. No discomfort or any noticeable increase in the size of the swelling before, during or after meals was experienced. An x-ray film showed a large radiopaque mass in the anterior portion of Wharton's duct. The calculus was removed under local anesthesia. Healing was rapid and uneventful, with no signs of cicatricial stenosis. The report is interesting in that a large salivary calculus (five-eighths by one-half inch) remained in Wharton's duct for a long time without causing symptoms and that an uncomfortable denture drew attention to it. Postoperative examination of the salivary stone revealed a decided grooving, indicating that the flow of saliva was not impeded. Sectioning of the mass revealed concentric laminations around a central nucleus which apparently contained no recognizable foreign substance. — *Brit. D. J.*, 73:260, November 1942.

PETER P. DALE.

Plexiform Neurofibroma (von Recklinghausen's Disease) Invading the Oral Cavity

By H. MARIN and C. L. GRAVES

Two cases of generalized von Recklinghausen's disease involving bulky invasion of the oral cavity are reported. Both occurred in children with involvement of the subcutaneous tissues, the bone and soft tissues investing the teeth, the floor of the mouth and one side of the tongue. In the case of a boy, the disease appeared to be benign. At 4 months, a prominence of the right side of the jaw was noted, which progressed slowly and was first observed by a physician at age 3. The tumor gradually became nodular, increased in size and at age 5 measured 6 by 2 by 2.5 cm. It was then removed through an external incision. Two years after the operation, a slowly progressing scoliosis developed. Since then, there has been a definite regrowth of the tumor, the size of which is not greatly out of proportion to the general development of the boy. In the case of a girl aged 5, a similar localized oral lesion became malignant and caused death. Necropsy revealed no signs of general dissemination.—*Am. J. Orthodontics*, 28:694, December 1942.

PETER P. DALE.

Suppurative Parotitis

By N. A. MCCORMICK

APPEARING with almost dramatic suddenness, parotitis is not only exceedingly painful, but is a serious complication of surgery. The infection usually reaches the gland from the mouth via Stensen's duct. The possibility of embolic infection also exists. The organism in most cases is the staphylococcus aureus. Any lowering of the general body resistance favors an increase in virulence of the normal buccal bacteria. The diminution of salivary flow which occurs in the presence of fever, dehydration, vomiting, or a restriction of oral fluids favors an ascending infection of the gland.

Prophylaxis must include adequate pre- and post-operative oral hygiene and dental care, mouthwashes being especially important, and the maintenance of general well-being.

It has previously been shown that the immediate use of radium over the infected gland materially reduces the incidence of suppuration, and thereby the morbidity and mortality.

Twenty cases are reported, in which it was found that 200 kv. x-ray therapy was practically a specific treatment, if instituted promptly and if combined with suitable supportive measures. Cases treated within six hours of the onset of the parotitis may be expected to resolve quickly. If treated in

from seven to sixteen hours, many will yet resolve. The others respond well symptomatically, but may drain a small amount of pus spontaneously. Cases seen sixteen or more hours after onset should also be treated. If they do not subside completely, suppuration takes place more quickly and clears up sooner than in non-irradiated cases, and there is much relief from pain. Surgical intervention should be delayed, and, if it becomes necessary, consists of very simple incision.

Irradiation results in marked reduction of the morbidity and high mortality of this disease.—*Canadian M. Ass. J.*, 47:29, 1942; *per Surg. Gynec. & Obs.*, 76:1, January 1943.

Congenital Malformations Induced in Rats by Maternal Nutritional Deficiency. II. Use of Varied Diets and of Different Strains of Rats

By JOSEF WARKANY, ROSE C. NELSON and ELIZABETH SCHRAFFENBERGER

CONGENITAL malformations developed in the offspring of female rats reared and bred on a deficient diet supplemented with viosterol to forestall possible rickets. The diet consisted of: yellow corn meal, 76 parts; wheat gluten, 20; chemically pure calcium carbonate, 3, and chemically pure sodium chloride, 1. The offspring numbered 517 normal and 244 abnormal rats up to the time of the writing. Malformations were more frequent in the second and later litters than the first. These have been discussed in a previous paper, but they consisted, for the most part, of a short mandible, protruding tongue, short and deformed extremities, syndactylism of the anterior extremities and fusion of the ribs. This experiment was designed to determine the relative effectiveness of various dietary supplements, the critical period of embryonic development in which the malformation developed and the effectiveness of the deficient diet in various strains of rats. Various dietary factors were tested and the one found most effective in correcting the malformations was 2 per cent pig liver. There was some indication that some crystalline factors of the vitamin B complex might also be effective. The liver offered protection if given any day prior to the fourteenth, but after that it was ineffective, an indication that the developmental period between the thirteenth and the fourteenth day should be considered as the period in which the nutritional factor under discussion exerts its influence. Tests on different strains of rats indicated that other strains of rats were more vigorous and hardy than the Wistar strain under the adverse conditions of the diet.—*Am. J. Dis. Child.*, 64:860, November 1942.

VIRGIL D. CHEYNE.

Problems in the Treatment of Malocclusion

By GEORGE W. HAHN

THE earlier orthodontic treatment is instituted, the more influence such correction will have upon growth and development of the face and jaws. In making a case analysis, the relation of the first permanent molars to the key ridge and of the lower central incisors to their bony foundation are two diagnostic points that should not be overlooked. Because of the comparative flatness of the articulating surfaces of the fossa and condyle head, the mandibular joint tolerates a surprising amount of distal movement early in life, an advantage in the treatment of class III malocclusion. Where an incipient bimaxillary protrusion is recognized in the early mixed dentition, it is good practice to extract the lower first deciduous molars to allow for the normal positioning of the first bicuspids, followed by removal of the second deciduous molars. The type and extent of orthodontic treatment must always be governed by the amount of movement necessary and the amount of anchorage available. In the adult patient, restoration of normal occlusion in its broadest sense is seldom possible owing to conditions over which the orthodontist has little or no control.—*Angle Orthodontist*, 12:61, April 1942.

PETER P. DALE.

ANNOUNCEMENTS

ANNOUNCEMENTS must be received by the fifth day of the month in order to be published in the forthcoming issues of THE JOURNAL.

CALENDAR OF MEETING

AMERICAN ACADEMY FOR PLASTICS RESEARCH IN DENTISTRY, Chicago, Ill., February 21.

AMERICAN ASSOCIATION OF DENTAL EDITORS, Chicago, Ill., February 22.

AMERICAN ASSOCIATION OF PUBLIC HEALTH DENTISTS, Chicago, Ill., February 21.

CHICAGO DENTAL SOCIETY, February 22-25.

CLEVELAND (OHIO) DENTAL SOCIETY SPRING CLINIC, May 10-12.

CLEVELAND (OHIO) DENTAL SOCIETY CHILDREN'S DENTAL HEALTH DAY, February 1.

DISTRICT OF COLUMBIA DENTAL SOCIETY, second and fourth Tuesdays in each month, from October to June at the United States Public Health Service Auditorium, Washington.

THOMAS P. HINMAN MID-WINTER CLINIC, Atlanta, Ga., March 28-30.

NEW YORK SOCIETY FOR ORAL DIAGNOSIS, New York, February 17.

NEW YORK SOCIETY OF ORTHODONTISTS, New York, March 8-9.

ALUMNI SOCIETY OF THE PHILADELPHIA DENTAL COLLEGE, Philadelphia, February 2.

GREATER PHILADELPHIA ANNUAL MEETING, February 3-5.

STATE SOCIETIES

February

Minnesota, at Minneapolis (17-19)
Washington, at Seattle (13)

March

Wisconsin, at Milwaukee (22-24)

April

California, at San Francisco (12-14)
Kentucky, at Louisville (5-7)
Louisiana, at New Orleans (8-10)
Michigan, at Detroit (19-21)
Oklahoma, at Oklahoma City (11-14)
Texas, at Fort Worth (19-22)
Virginia, at Roanoke (19-21)

May

Connecticut, at Hartford (5-7)
Georgia, at Atlanta (17-19)
Illinois, at Peoria (10-14)
Indiana, at Indianapolis (17-19)
Iowa, at Des Moines (3-5)
Kansas, at Kansas City, Mo. (11-13)
Maryland, at Baltimore (3-4)
Massachusetts, at Boston (17-20)
Mississippi, at Jackson (17-18)
Missouri, at Kansas City (10-13)
Montana, at Great Falls (6-8)
Nebraska, at Omaha (10-12)
New Jersey, at Newark (4-5)
New York, at Syracuse (18-21)
North Carolina, at Greensboro (3-5)
Pennsylvania, at Pittsburgh (4-6)
South Carolina, at Columbia
South Dakota, at Huron (9-11)
Tennessee, at Nashville (10-13)
Vermont, at Burlington (19-20)
West Virginia, at Parkersburg (17-19)

June

Colorado, at Denver (17-19)
District of Columbia, at Washington (8)
Nevada, at Reno
New Mexico, at Carlsbad
Oregon, at Portland (10-12)
Utah, at Salt Lake City (3-5)
Wyoming, at Casper

September

Southern California, at Los Angeles (13-15)

November

Ohio, at Cleveland (7-10)

January 1944

Rhode Island, at Providence

STATE BOARDS OF DENTAL EXAMINERS

Alabama, at Birmingham, March 15. W. A. Wood, Merchants National Bank Bldg., Mobile, Secretary.

Arizona, at Phoenix, March 29. R. K. Trueblood, 25 N. Second St., Glendale, Secretary.

California, at San Francisco, February 15 and April 19, and at Los Angeles, March 22. Kenneth I. Nesbitt, 515 Van Ness Ave., San Francisco, Secretary.

Delaware, at Wilmington, April 6-9 (dentists); June 15-17 (dental hygienists). Charles R. Jefferis, Medical Arts Bldg., Wilmington, Secretary.

Florida, at Jacksonville, March 15-18. H. B. Pattishall, 351 St. James Bldg., Jacksonville, Secretary.

Kentucky, at Louisville, March 9-12. W. F. Walz, 1114 First National Bank Bldg., Lexington, Acting Secretary.

Minnesota, at Minneapolis, March 15-20. G. R. Metcalf, Barnesville, Secretary.

New Jersey, April 5-9. Walter A. Wilson, 150 E. State St., Trenton, Secretary.

North Carolina, at Raleigh, April 5. Wilbert Jackson, Rich Building, Clinton, Secretary.

North Dakota, at Fargo, July 12-15. R. A. Andrews, Carrington, Secretary.

Ohio, at Cleveland, February 8-10, or Columbus, March 1-3 (practical); at Columbus, March 22-24 (theoretical). Earl D. Lowry, 79 E. State St., Columbus, Secretary.

South Carolina, at Columbia, March 25-27. T. C. Sparks, 1508 Washington St., Columbia, Secretary.

Tennessee, at Memphis, March 22-25. W. W. Martin, 115 W. Jefferson St., Pulaski, Secretary.

Pennsylvania, at Pittsburgh and Philadelphia, February 16-20 (dentists); May 27-28 (dental hygienists). Reuben E. V. Miller, 61 N. Third St., Easton, Secretary.

Texas, at Houston, March 23-26. Carl C. Hardin, Jr., 520 Littlefield Bldg., Austin, Secretary.

Virginia, at Richmond, March 30. John M. Hughes, 715 Medical Arts Bldg., Richmond, Secretary.

Wisconsin, at Milwaukee, February 8-12. S. F. Donovan, Tomah, Secretary.

AMERICAN ACADEMY FOR PLASTICS RESEARCH IN DENTISTRY

THE meeting of the American Academy for Plastics Research in Dentistry will be held in the Palmer House, Chicago, February 21. Application for admission to the scientific session should be made to the secretary.

LAMAR W. HARRIS, *Secretary,*
25 E. Washington St.,
Chicago, Ill.

AMERICAN ASSOCIATION OF DENTAL EDITORS

AN informal meeting of the American Association of Dental Editors will be held February 22, at the Palmer House, Chicago, 10 a.m. to 1 p.m. All members are invited to attend.

O. W. BRANDHORST, *Secretary,*
4952 Maryland Ave.,
St. Louis, Mo.

AMERICAN ASSOCIATION OF PUBLIC HEALTH DENTISTS

THE midwinter meeting of the Executive Council of the American Association of Public Health Dentists will be held at the Palmer House in Chicago, February 21, at 9 a.m. All members of the association attending the Chicago Dental Society Midwinter Meeting are invited to be present.

FRANK C. CADY, *Secretary,*
USPHS Hospital,
Lexington, Ky.

AMERICAN ASSOCIATION OF ORTHODONTISTS

THE annual meeting of the American Association of Orthodontists which was to have been held in Chicago, May 3-6, has been cancelled.

MAX E. ERNST, *Secretary,*
St. Paul, Minn.

CHICAGO DENTAL SOCIETY MIDWINTER MEETING

THE 1943 Midwinter Meeting of the Chicago Dental Society will be held at the Palmer House, February 22-25.

HAROLD W. OPPICE, *Secretary.*

CLEVELAND DENTAL SOCIETY SPRING CLINIC

THE annual spring clinic meeting of the Cleveland Dental Society will be held May 10-12 at the Statler Hotel.

ALBIUN F. SADD, *Chairman,*
Publicity Committee,
7904 Superior Ave.,
Cleveland.

CLEVELAND DENTAL SOCIETY CHILDREN'S DENTAL HEALTH DAY

THE annual Children's Dental Health Day of the Cleveland Dental Society will be held February 1 at the Hotel Statler.

HOMER C. ALEXANDER, *Chairman,*
Printed Publicity.

THOMAS P. HINMAN MIDWINTER CLINIC

THE 1943 Thomas P. Hinman Mid-Winter Clinic will be held at the Biltmore Hotel, Atlanta, Ga., March 28-30.

THOMAS CONNER, *Chairman,*
604 Doctors Bldg.,
Atlanta, Ga.

NEW YORK SOCIETY FOR ORAL DIAGNOSIS

THE next meeting of the New York Society for Oral Diagnosis will be held February 17 at 9 p.m., at Squibb Hall, 745 Fifth Ave., New York.

H. JUSTIN ROSS, *Secretary,*
515 Madison Ave.,
New York.

NEW YORK SOCIETY OF ORTHODONTISTS

THE spring meeting of the New York Society of Orthodontists will be held at the Waldorf-Astoria Hotel, New York, March 8-9.

NORMAN L. HILLYER, *Secretary,*
Professional Bldg.,
Hempstead.

PAN AMERICAN MEDICAL ASSOCIATION

THE Pan American Medical Association is planning a war congress to be held in New York in May or June. The president of the association, José Arce, of Buenos Aires, on a recent visit to the United States, received the sanction of the U. S. State Department for the congress; subject to conditions that may arise. The Section on Dentistry is to play an important part and arrangements for the dental program are being made.

ALFRED WALKER, *President,*
501 Madison Ave.,
New York.

ALUMNI SOCIETY OF THE PHILADELPHIA DENTAL COLLEGE

THE eightieth annual session of the Alumni Society of Philadelphia Dental College (Temple University School of Dentistry) will be held February 2 at Kugler's Restaurant on Chestnut Street, with the annual business meeting and election of officers at 6 p.m., reception to Dean and Mrs. Gerald D. Timmons at 6:30, and the annual reunion dinner dance at 7 o'clock, with addresses by R. L. Johnson, president of Temple University, and Gerald D. Timmons, dean of the dental school. For further information, address

DAVID K. WALDMAN,
Chairman of Publicity,
5303 Chester Ave.,
Philadelphia.

GREATER PHILADELPHIA ANNUAL MEETING

THE Greater Philadelphia Annual Meeting will be held February 3-5, at the Benjamin Franklin Hotel.

ABRAM COHEN, *Chairman,*
Publicity Committee,
269 E. 19th St.,
Philadelphia.

CALIFORNIA STATE DENTAL ASSOCIATION

THE next annual meeting of the California State Dental Association will be held in San Francisco, at the Fairmont Hotel, April 12-14.

LLOYD E. LINEHAN, *Secretary,*
450 Sutter St.,
San Francisco.

SOUTHERN CALIFORNIA STATE DENTAL ASSOCIATION

THE next annual meeting of the Southern California State Dental Association will be held in Los Angeles, at the Ambassador Hotel, September 13-15.

ROBERT L. BORLAND, *Secretary,*
602 Chapman Bldg.,
Los Angeles.

COLORADO STATE DENTAL ASSOCIATION

THE next annual meeting of the Colorado State Dental Association will be held in Denver, at the Cosmopolitan Hotel, June 17-19.

CHARLES K. PHILLIPS, *Secretary,*
529 Majestic Bldg.,
Denver.

CONNECTICUT STATE DENTAL ASSOCIATION

THE next annual meeting of the Connecticut State Dental Association will be held in Hartford, May 5-7.

EARLE S. ARNOLD, *Secretary,*
37 Linnard Road,
West Hartford.

DISTRICT OF COLUMBIA DENTAL SOCIETY

THE next annual meeting of the District of Columbia Dental Society will be held in Washington, June 8.

J. WALTER BERNHARD, *Secretary*,
1835 Eye St., N. W.,
Washington.

GEORGIA DENTAL ASSOCIATION

THE next annual meeting of the Georgia Dental Association will be held in Atlanta at the Ansley Hotel, May 17-19.

R. H. MURPHY, *Secretary*,
605 Bankers Insurance Bldg.,
Macon.

ILLINOIS STATE DENTAL SOCIETY

THE next annual meeting of the Illinois State Dental Society will be held in Peoria, May 10-14.

L. H. JACOB, *Secretary*,
634 Jefferson Bldg.,
Peoria.

INDIANA STATE DENTAL ASSOCIATION

THE next annual meeting of the Indiana State Dental Association will be held in Indianapolis, at the Claypool Hotel, May 17-19.

E. E. EWBANK, *Secretary*,
Kingman.

IOWA STATE DENTAL SOCIETY

THE next annual meeting of the Iowa State Dental Society will be held in Des Moines, at the Hotel Fort Des Moines, May 3-5.

C. S. FOSTER, *Secretary*,
803 Dows Bldg.,
Cedar Rapids.

KANSAS STATE DENTAL ASSOCIATION

THE next annual meeting of the Kansas State Dental Association will be held in Kansas City, Mo., May 11-13.

FRED A. RICHMOND, *Secretary*,
Huron Bldg.,
Kansas City, Kan.

KENTUCKY STATE DENTAL ASSOCIATION

THE next annual meeting of the Kentucky State Dental Association will be held April 5-7 at the Brown Hotel, Louisville.

J. L. WALKER, *Secretary*,
640 Barbee Way South,
Louisville.

LOUISIANA STATE DENTAL SOCIETY

THE next annual meeting of the Louisiana State Dental Society will be held in New Orleans, at the Roosevelt Hotel, April 8-10.

JULIAN S. BERNHARD, *Secretary*,
407 Medical Arts Bldg.,
Shreveport.

MARYLAND STATE DENTAL ASSOCIATION

THE annual meeting of the Maryland State Dental Association will be held in Baltimore, May 3-4.

PAUL A. DEEMS, *Secretary*,
Medical Arts Bldg.,
Baltimore.

MASSACHUSETTS DENTAL SOCIETY

THE next meeting of the Massachusetts Dental Society will be held in Boston, at the Hotel Statler, May 17-20.

PHILIP E. ADAMS, *Secretary*,
106 Marlborough St.,
Boston.

MICHIGAN STATE DENTAL SOCIETY

THE next annual meeting of the Michigan State Dental Society will be held in Detroit, at the Hotel Statler, April 19-21.

WILLIAM R. DAVIS, *Secretary*,
Michigan Dept. of Health,
Lansing.

MINNESOTA STATE DENTAL ASSOCIATION

The sixtieth annual meeting of the Minnesota State Dental Association will be held in the Municipal Auditorium, Minneapolis, February 17-19.

L. M. CRUTTENDEN, *Secretary*,
498 Lowry Bldg.,
St. Paul.

MISSISSIPPI DENTAL ASSOCIATION

THE next annual meeting of the Mississippi Dental Association will be held in Jackson, May 17-18.

O. L. COLEE, *Secretary*,
Magnolia.

MISSOURI STATE DENTAL ASSOCIATION

THE next annual meeting of the Missouri State Dental Association will be held in Kansas City, May 10-13, in conjunction with the Kansas State Dental Association meeting.

C. W. DIGGS, *Secretary,*
Columbia.

MONTANA STATE DENTAL ASSOCIATION

The next annual meeting of the Montana State Dental Association will be held in Great Falls, May 6-8.

T. T. RIDER, *Secretary,*
Missoula.

NEBRASKA STATE DENTAL ASSOCIATION

The next annual meeting of the Nebraska State Dental Association will be held in Omaha, at the Fontenelle Hotel, May 10-12.

C. A. BUMSTEAD, *Secretary,*
Stuart Bldg.,
Lincoln.

NEVADA STATE DENTAL ASSOCIATION

THE next annual meeting of the Nevada State Dental Association will be held in Reno, in June.

LOUIS M. NELSON, *Secretary,*
Reno.

NEW HAMPSHIRE DENTAL SOCIETY

THE next annual meeting of the New Hampshire Dental Society will be held in Boston, Mass.

FLOYD E. WILLIAMS, *Secretary,*
Manchester.

NEW JERSEY STATE DENTAL SOCIETY

THE next meeting of the New Jersey State Dental Society will be held in Newark, at the Newark Athletic Club, May 4-5.

F. K. HEAZELTON, *Secretary,*
223 East Hanover St.,
Trenton.

NEW MEXICO STATE DENTAL SOCIETY

THE next annual meeting of the New Mexico State Dental Society will be held in Carlsbad in June.

J. S. EILAR, *Secretary,*
Albuquerque.

DENTAL SOCIETY OF THE STATE OF NEW YORK

THE next annual meeting of the Dental Society of the State of New York will be held in Syracuse, at the Hotel Syracuse, May 18-21.

CHARLES A. WILKIE, *Secretary,*
One Hanson Place,
Brooklyn.

NORTH CAROLINA DENTAL SOCIETY

THE next annual meeting of the North Carolina Dental Society will be held in Greensboro, at the O'Henry Hotel, May 3-5.

E. M. MEDLIN, *Secretary,*
Aberdeen.

OHIO STATE DENTAL SOCIETY

THE next annual meeting of the Ohio State Dental Society will be held in Cleveland, November 7-10.

EDWARD C. MILLS, *Secretary,*
255 E. Broad St.,
Columbus.

OKLAHOMA STATE DENTAL SOCIETY

The next annual meeting of the Oklahoma State Dental Society will be held in Oklahoma City, at the Skirvin Hotel, April 11-14.

EUGENE W. WISE, *Secretary,*
Medical Arts Bldg.,
Tulsa.

OREGON STATE DENTAL ASSOCIATION

THE next annual meeting of the Oregon State Dental Association will be held in Portland, June 10-12.

F. W. HOLLISTER, *Secretary,*
Selling Bldg.,
Portland.

PENNSYLVANIA STATE DENTAL SOCIETY

THE next annual meeting of the Pennsylvania State Dental Society will be held in Pittsburgh, at the William Penn Hotel, May 4-6.

EDWARD R. ASTON, *Secretary,*
421 Market St.,
Kingston.

RHODE ISLAND STATE DENTAL SOCIETY

THE next meeting of the Rhode Island

State Dental Society will be held in Providence in January 1944.

CHARLES F. MCKIVERGAN,
Secretary Pro Tem.,
102 Waterman St.,
Providence.

SOUTH CAROLINA STATE DENTAL ASSOCIATION

THE next annual meeting of the South Carolina State Dental Association will be held in Columbia in May.

P. B. HAIR, *Secretary*,
Spartanburg.

SOUTH DAKOTA STATE DENTAL SOCIETY

THE next annual meeting of the South Dakota State Dental Society will be held in Huron, May 9-11.

ERNEST W. ELMEN, *Secretary*,
Sioux Falls.

TENNESSEE STATE DENTAL ASSOCIATION

THE officers of the Tennessee State Dental Association will hold its annual meeting in Nashville, May 10-13, at Hotel Andrew Jackson.

E. JEFF JUSTIS, *Secretary*,
1504 Exchange Bldg.,
Memphis.

TEXAS STATE DENTAL SOCIETY

THE next annual meeting of the Texas State Dental Society will be held in Fort Worth, April 19-22.

WILLARD OGLE, *Secretary*,
Medical Arts Bldg.,
Dallas.

UTAH STATE DENTAL ASSOCIATION

THE next annual meeting of the Utah State Dental Association will be held in Salt Lake City, June 3-5.

C. G. GREEN, *Secretary*,
1001 Boston Bldg.,
Salt Lake City.

VERMONT STATE DENTAL SOCIETY

THE next annual meeting of the Vermont State Dental Society will be held in Burlington, May 19-20.

J. GILLAM IRONS, *Secretary*,
Bennington.

VIRGINIA STATE DENTAL ASSOCIATION

THE next annual meeting of the Virginia State Dental Association will be held at the Hotel Roanoke, Roanoke, April 19-21.

J. E. JOHN, *Secretary*,
Medical Arts Bldg.,
Roanoke.

WASHINGTON STATE DENTAL ASSOCIATION

THE next annual meeting of the Washington State Dental Association will be held in Seattle, February 13.

A. W. JEFFERY, *Secretary*,
533 Medical & Dental Bldg.,
Seattle.

WEST VIRGINIA STATE DENTAL SOCIETY

THE next annual meeting of the West Virginia State Dental Society will be held in Parkersburg, May 17-19.

M. H. NICHOLSON, *Secretary*,
Bluefield.

WISCONSIN STATE DENTAL SOCIETY

THE annual meeting of the Wisconsin State Dental Society will be held at the Schroeder Hotel, Milwaukee, March 22-24.

KENNETH F. CRANE, *Executive Secretary*,
1233 Bankers Bldg.,
Milwaukee.

WYOMING STATE DENTAL ASSOCIATION

THE next annual meeting of the Wyoming State Dental Association will be held in Casper in June.

J. D. MCNIFF, *Secretary*,
Laramie.

BOARD OF DENTAL EXAMINERS OF ALABAMA

THE Board of Dental Examiners of Alabama will conduct its next annual dental examination beginning March 15, in Birmingham. All credentials must be filed with the secretary at least two weeks in advance of the examination. Address all correspondence to

W. A. WOOD, *Secretary*,
Merchants National Bank Bldg.,
Mobile.

ARIZONA STATE DENTAL BOARD

THE next examination to be conducted by

the Arizona State Dental Board for a license to practice dentistry in Arizona will be held in Phoenix commencing March 29. All credentials must be in the office of the secretary March 15. This will be the only examination conducted by the state board in 1943. Address all communications to

R. K. TRUEBLOOD, *Secretary,*
25 N. Second Ave.,
Glendale.

BOARD OF DENTAL EXAMINERS OF CALIFORNIA

THE next examinations to be conducted by the Board of Dental Examiners of California for a license to practice dentistry and for a license to practice dental hygiene in California will be held in San Francisco, commencing on February 15; in Los Angeles, commencing on March 22, and again in San Francisco commencing on April 19. All credentials must be in the office of the Secretary, Room 203, 515 Van Ness Avenue, San Francisco, at least twenty days prior to the date of the examinations. Address all communications to Kenneth I. Nesbitt, Secretary, Room 203, 515 Van Ness Ave., San Francisco.

DELAWARE STATE BOARD OF DENTAL EXAMINERS

THE next examinations conducted by the Delaware State Board of Dental Examiners will be held April 6-9, for applicants for dental licenses, and June 15-17 for applicants for licenses as dental hygienists. All examinations will be held in Wilmington.

CHARLES R. JEFFERIS, *Secretary,*
Medical Arts Bldg.,
Wilmington.

FLORIDA STATE BOARD OF DENTAL EXAMINERS

THE Florida State Board of Dental Examiners will hold its annual examination of applicants for license to practice dentistry and dental hygiene in Florida at Jacksonville in the Seminole Hotel, March 15-18. Applicants for a license to practice dentistry must file preliminary applications by January 14. Final applications for license to practice dentistry or dental hygiene must be complete by February 13. Address all communications to

H. B. PATTISHALL, *Secretary,*
351 St. James Bldg.,
Jacksonville.

KENTUCKY STATE BOARD OF DENTAL EXAMINERS

THE next meeting of the Kentucky State Board of Dental Examiners will be held March 9-12, at the University of Louisville Dental School, Louisville. Dentists who graduated prior to 1943 and who wish to stand examination before this board must file applications, complete with full information requested, at this office not later than January 9. Applications of 1943 graduates must be in the secretary's office by February 9. Dental hygienists who have completed a two-year course and who desire to stand examination before this board must file applications with the board by February 9. Ample time should be allowed for securing all data required. For application forms and further information, apply to

W. F. WALZ, *Acting Secretary,*
1114 First National Bank Bldg.,
Lexington.

MINNESOTA STATE BOARD OF DENTAL EXAMINERS

THE next examination to be conducted by the Minnesota State Board of Dental Examiners will be held at the College of Dentistry, University of Minnesota, Minneapolis, March 15-20. All examination fees must be in the hands of the secretary at least ten days before the date of examination. Address all communications to

G. R. METCALF, *Secretary,*
Barnesville.

NEW JERSEY STATE BOARD OF REGISTRATION AND EXAMINATION IN DENTISTRY

THE State Board of Registration and Examination in Dentistry of New Jersey will hold its next examination commencing April 5, and continuing for five days. Upon application to the secretary, a copy of the requirements and rules, instruction sheet and preliminary application will be sent. Any person desiring to apply as a candidate must file the preliminary application blank, together with the examination fee of $25, on or before February 15.

WALTER A. WILSON, *Secretary,*
150 E. State St.,
Trenton.

NORTH CAROLINA STATE BOARD OF DENTAL EXAMINERS

THE next meeting of the North Carolina

State Board of Dental Examiners for the examination of applicants for licensure will be held at the state capitol, Raleigh, beginning April 5. Applications must be filed with the secretary thirty days before the examination. For application blanks and further information, address

WILBERT JACKSON, *Secretary,*
Rich Building,
Clinton.

NORTH DAKOTA STATE BOARD OF DENTAL EXAMINERS

THE North Dakota State Board of Dental Examiners will hold its next examination in the Gardner Hotel, Fargo, July 12-15. For further information and applications, address

R. A. ANDREWS, *Secretary,*
Carrington.

OHIO STATE DENTAL BOARD

THE practical examination of the Ohio State Dental Board will be held at Western Reserve University School of Dentistry, Cleveland, February 8-10, and at Ohio State University College of Dentistry, Columbus, March 1-3. The practical examination may be taken either in Cleveland or in Columbus, provided due notice is given to the secretary. The theory examination will be held in Columbus, March 22-24. All applications must be in the hands of the secretary at least ten days before the date of the examination. For further information, apply to

EARL D. LOWRY, *Secretary,*
79 E. State St.,
Columbus.

DENTAL COUNCIL AND EXAMINING BOARD OF THE COMMONWEALTH OF PENNSYLVANIA

THE Dental Council and Examining Board of the Commonwealth of Pennsylvania will meet in Philadelphia and Pittsburgh, February 16-20, to examine applicants for license to practice dentistry. An examination for license to practice dental hygiene will be given in Philadelphia and Pittsburgh, May 27-28. For further information and application blanks, address the Department of Public Instruction, Bureau of Professional Licensing, Dental Division, Harrisburg.

REUBEN E. MILLER, *Secretary,*
61 N. Third St.,
Easton.

SOUTH CAROLINA STATE BOARD OF DENTAL EXAMINERS

THE South Carolina State Board of Dental Examiners will hold its next meeting in Columbia, March 25-27. All applications must be filled out and returned to the secretary at least thirty days before the examination.

T. C. SPARKS, *Secretary,*
1508 Washington St.,
Columbia.

TENNESSEE BOARD OF DENTAL EXAMINERS

THE next examination for licensure of the Tennessee State Board of Dental Examiners will be held in Memphis at the College of Dentistry, University of Tennessee, March 22-25. All applications and fees must be in the hands of the secretary thirty days before the date of the examination. For applications and other information, address

W. W. MARTIN, *Secretary,*
115 W. Jefferson St.,
Pulaski.

TEXAS BOARD OF DENTAL EXAMINERS

THE Texas Board of Dental Examiners will hold its next examination March 23-26, in Houston. Graduates only will be examined. Applications must be filed at least ten days prior to the date of examination. For further information, address

CARL C. HARDIN, JR.,
Executive Secretary,
520 Littlefield Bldg.,
Austin.

VIRGINIA STATE BOARD OF DENTAL EXAMINERS

THE next regular meeting of the Virginia State Board of Dental Examiners will be held at the Medical College of Virginia, Richmond, beginning at 9 a.m., March 30. Each applicant will be required to present a certificate from the Virginia State Board of Education, State Office Building, Richmond, showing that he has had at least one year of academic education equal to one year of college work. He must be a graduate of a Class A dental college and must be prepared to do any kind of practical or operative work necessary to the general practice of dentistry. The theoretical examination covers subjects usually found in a complete

dental curriculum. No applications will be accepted after March 20. For application blanks and further information, apply to

JOHN M. HUGHES, *Secretary,*
715 Medical Arts Bldg.,
Richmond.

WISCONSIN STATE BOARD OF DENTAL EXAMINERS

THE Wisconsin State Board of Dental Examiners will hold its next examination, February 8-12, at Marquette University Dental School, Milwaukee, for the licensure of dentists and dental hygienists. For applications and full particulars, address the secretary. No applications will be accepted after February 2.

S. F. DONOVAN, *Secretary,*
Tomah.

EXAMINATION FOR APPOINTMENT IN THE DENTAL CORPS OF THE NAVY

THE next examination for appointment as assistant dental surgeon, U. S. Navy (lieutenant [junior grade], Dental Corps, U. S. Navy) will be held at the Naval Training Station, Norfolk, Va.; the Naval Training Station, Great Lakes, Ill.; the Naval Training Station, San Diego, Calif., and the Naval Dental School, National Naval Medical Center, Bethesda, Md., May 3. Application for this examination should be made to the chief of the Bureau of Medicine and Surgery, Navy Department, Washington, D. C. Applicants for appointment as assistant dental surgeon must be citizens of the United States, more than 21 but less than 32 years of age at the time of acceptance of appointment, and graduates of a class A dental school. A circular of information listing physical and other requirements for appointment, subjects in which applicants are examined and other data pertaining to salary, allowances, etc., can be obtained from the Bureau of Medicine and Surgery, Navy Department, Washington, D. C.

CARNEGIE FELLOWSHIPS FOR RESEARCH AND GRADUATE WORK IN THE DENTAL SCIENCES

AIDED by the Carnegie Corporation of the New York and the Eastman Dental Clinic, the School of Medicine and Dentistry of the University of Rochester offers scholarships paying $1,200-$1,800 per annum to well-trained dental graduates who are interested in research or who desire special training in the basic medical sciences as an aid to dental teaching or practice. A few fellowships also offer part-time training in oral surgery. On appointment, the applicant is given the title of Fellow in Dentistry and, according to his interest, works as a graduate student in one of the departments of the medical schools. Here, excellent laboratory facilities, adequate direction and close contact with various investigations related to medicine and dentistry help his research and study. Fellows are encouraged to attend medical classes, seminars and staff meetings and, when opportunity presents itself, to participate in class instruction and scientific meetings. Contact with the problems of clinical dentistry may be maintained through the Oral Surgery Clinic of the Strong Memorial Hospital and the Rochester Dental Dispensary. With the approval of the Graduate Council of the university, Fellows may prepare themselves for the degree of M.S., or Ph.D. Applications should be made to

GEORGE H. WHIPPLE, *Dean,*
Rochester, N. Y.

COLUMBIA UNIVERSITY COURSE FOR ORTHODONTISTS

THE School of Dental and Oral Surgery of Columbia University announces an intensive theoretical and practical course for orthodontists under the direction of Robert H. W. Strang, assisted by Will H. Thompson, Jr., and Glenn H. Whitson, January 17-30. The course will consist of lectures and technical training in the construction of bands, the lingual arch and the twin wire mechanism.

Admission to the course is limited to members in good standing of the American Association of Orthodontists or of generally recognized sectional organizations of orthodontic specialists in America and foreign countries, or those who have passed the American Board of Orthodontics. For further information, address the Assistant to the Registrar, School of Dental and Oral Surgery, 630 West 168th St., New York, N. Y.

UNITED STATES PATENTS APPLICABLE OR PERTAINING TO DENTISTRY ISSUED DURING NOVEMBER-DECEMBER 1942

November 3

2,300,577, JOHN B. LA DUE and JACOB A. SAFFIR. Artificial tooth.

2,300,828, ALEXANDER M. GOLDENBERG. Dental cleansing device.

November 10

2,301,174, CHARLES DIETZ. Fluorescent artificial teeth.

2,301,358, CHARLES S. BALLARD. Intra-oral denture correlator.

2,301,825, MICHAEL RUSSELL STEIN and JOSEPH KOHN. Artificial tooth.

November 17

2,302,265, MARSHALL T. SEAGRAVE. Osteotome.

2,302,375, SIMON MYERSON. Artificial tooth and method of making the same.

2,302,376, SIMON MYERSON. Method of and apparatus for use in carding artificial teeth

D-134,367, LYLE E. FRY and RAYMOND D. CHAMPION. Design for a pocket toothbrush or similar article.

December 1

2,303,401, CECIL SPENCER SIVIL. Resistance or fuse wire.

2,303,402, CECIL SPENCER SIVIL. Alloy.

2,303,403, CECIL SPENCER SIVIL. Resistance or fuse wire.

2,303,404, CECIL SPENCER SIVIL. Alloy.

2,303,405, CECIL SPENCER SIVIL. Alloy.

2,303,475, KARL AXEL SAM KARLSTROM. Device for the parallel guidance of tools in performing dental work.

2,303,600, CONSTANT A. BENOIT and HERMAN C. FUCHS. Dental impression material.

2,303,667, ALFRED F. TABORSKI. Toothbrush.

2,303,874, ARTHUR NUTTER BROWN. Artificial tooth.

December 8

2,304,319, AUGUSTE L. SALTZMAN. Toothbrush.

2,304,391, OSWALD T. ZIMMERMAN. Cement.

2,304,416, JOSEF LEUSER. Dental alloy.

2,304,675, RALPH H. BOOS. Gnathodynamometer.

D-134,523, ARTHUR G. MERKER. Design for a clasp forming pliers.

December 15

2,305,156, FRANK J. GRUBEL. Box lock pivot and method of assembling same.

2,305,278, ARTHUR E. SMITH. Syringe construction.

2,305,367, GEORGE FARRELL WEBB. Tooth vitality tester.

2,305,461, PAUL SPYRA. Toothbrush.

December 22

2,305,784, LAJOS HORVATH and SAMUEL ZÁGONYI. Device for treating the human masticating apparatus.

2,305,854, RAYMOND E. ENGLISH. Dental pressure tray equipment.

2,305,916, SPENCER R. ATKINSON. Orthodontic appliance.

2,306,264, FENN G. HART. Rotary toothbrush.

2,306,296, EDWARD L. CHOTT and GEORGE A. CHOTT. Amalgamator.

2,306,344, ROSS E. O'MORROW. Artificial tooth.

D-134,603, GEORGE E. FROELICH. Design for a combined dentist's cabinet and x-ray picture display support.

December 29

2,306,482, CALLARD LIVINGSTON. Toothbrush.

2,306,516, ERIC H. ZAHN. Method of making hollow casting molds.